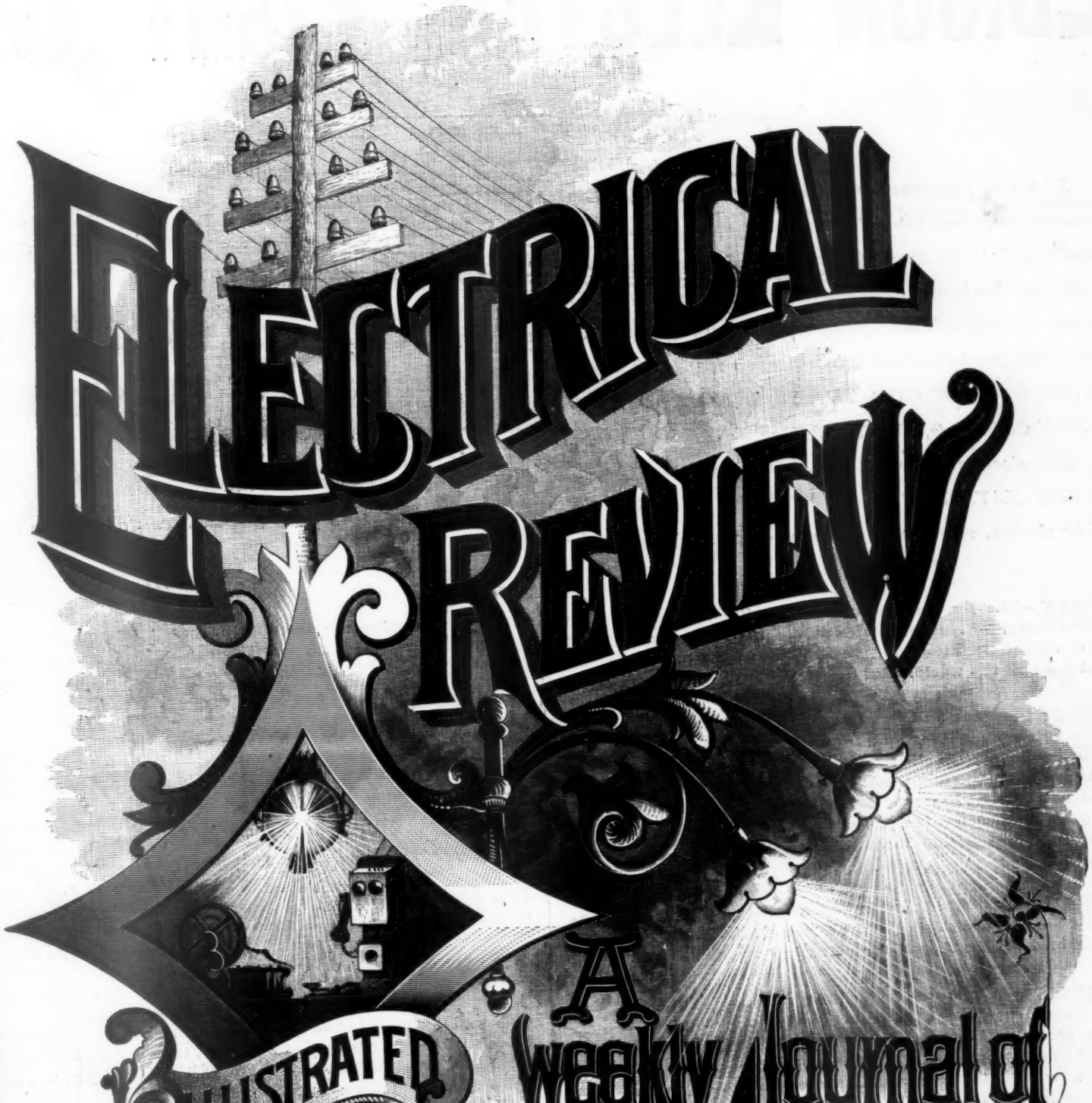

ILLUSTRATED

A weekly Journal of

ELECTRIC LIGHT AND POWER, TELEGRAPH, TELEPHONY & SCIENTIFIC PROGRESS.

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EDISON ELECTRIC LIGHT CO.

So much has been said in relation to PATENT DECISIONS, and we have been so urgently and repeatedly requested to refute the misstatements and misrepresentations of electrical companies who have been in the habit of rushing into the Press upon any and every slight pretext, that we have decided to give a brief synopsis of the facts. In the preliminary movements of the legal campaign which we have inaugurated for the protection of our patents, the defendants have pursued only dilatory and evasive tactics, notwithstanding their pretense of anxiety to have the fight conducted in an open field and the issue determined on its merits. The potent fact still remains that NO ONE OF OUR THREE HUNDRED PATENTS HAS EVER BEEN SET ASIDE OR ADJUDICATED IN ANY COURT OF LAW IN THE UNITED STATES.

The decisions actually rendered in the Courts of Europe and America are thirteen in number, of which ELEVEN HAVE BEEN IN FAVOR OF THE EDISON PATENTS and only two against them: and these two, as will be shown, were purely of a preliminary character.

FIRST.--**The fundamental or "filament" patent on the lamp has been sustained six times in Germany after a very closely and hotly contested litigation and in the face of the most stringent patent laws in the world.**

SECOND.—**Some two years ago the English Edison Company brought suit against Woodhouse and Rawson and after a bitter controversy in the English Court, Mr. Justice Butt sustained the Edison filament patent, and his decision, based as it was on a question of fact, has now become famous as establishing beyond question of doubt the priority of Edison's right to the only commercially practicable incandescent lamp, viz: "a filament of high resistance."**

THIRD.—**The defendants in the above-mentioned suits appealed from the decision of Mr. Justice Butt, but his decision was affirmed by the Appellate Court.**

FOURTH.—**A suit was brought by the English Edison Company upon a patent which describes a process of building up carbon conductors by electro-chemical action. This suit was decided in favor of the English Edison Company, but the process is not now used in the manufacture of its lamp by the Edison Company in this country.**

FIFTH.—**The recent decision of Judge Kay against the English Edison Company involved the "filament" patent, the same as was covered by the suits mentioned in the 2d and 3d paragraphs above, upon which patent all previous decisions, both in England and Germany have been in favor of Edison. The adverse decision of Judge Kay will be immediately appealed from and as the Appellate Court is the same which has already decided IN EDISON'S FAVOR ON THE SAME PATENT (see paragraphs 2 and 3 above) there can be little doubt but that the decision will be again in Edison's favor.**

In this country no decision on this important patent has ever been rendered, and as the English decision could not in any way affect the patent in this Country, the recent attempts, through the medium of newspaper interviews and correspondence, and otherwise to give the impression that ANY Edison American patent is invalidated in consequence of Judge Kay's decision bear the stamp of intentional misrepresentation.

SIXTH.—**In the suits brought by us against the United States Electric Light Company in the New York Courts, the defendants set up a plea that certain foreign patents upon the same invention had expired and that in consequence the American patent is void. We demurred to this plea, but Judge Wallace decided against us, and the defendants will now be compelled to defend themselves against our next and more serious onslaught, in which we propose to prove that the foreign patents HAVE NOT EXPIRED. Even should we fail in establishing this question of fact, we shall then be prepared to show that by a proper and equitable interpretation of the statute the expiration of a foreign patent does not invalidate the American patent. This latter we hold to be an absolutely impregnable position, constructed of the material essence of all equitable law and common sense. It will be seen from the foregoing that instead of having won the twenty-six suits, as is so audaciously claimed by the unscrupulous officers of the United States Company, they have merely won an incidental plea, which gives them a foot-hold upon the battlefield. The real fight has as yet not begun.**

SEVENTH.—**In the suits brought by us against the Westinghouse Company in Trenton, N. J., they moved to dismiss our bill on the ground that the old Edison Company (prior to its consolidation with the Isolated Company), in whose name the suits were filed, has, by means of that consolidation, not sufficient life to prosecute these suits. Judge Wales decided this point in our favor,and therefore the Westinghouse Company are now compelled to meet the issue squarely.**

EIGHTH.—**In the suit brought by us against the Thomson-Houston Company in New Haven, Conn., after similar tactics were pursued, the claim was there set up that the new Edison Company in whose name the suits were filed, had not sufficient title to maintain them. Judge Shipman decided this point in our favor, and the Thomson-Houston Company are therefore now compelled to answer the charge of infringement.**

EDISON ELECTRIC LIGHT CO.,

16 & 18 BROAD STREET, NEW YORK.

By EDWARD H. JOHNSON, President

ELECTRICAL REVIEW

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A WEEKLY JOURNAL OF

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Electric Light Poles for Street Illumination in Berlin, Germany.

We have the pleasure to place before our readers, a few engravings representing the style of electric light poles as they have been erected in the principal streets of the German capital. It will be seen that the poles used for the same purpose in the metropolis of the American continent, exhibit a sorry figure when compared with the artistic conceptions of our German cousins. We are indebted for the engravings and description to the *Centralblatt der Bauverwalting*, published semi-weekly in Berlin, and which reached us by the kind intervention of Mayor Hewitt, to whom we would express our sincere thanks. The figures have been reproduced by us and we give an extract of the article, which was written by Herr L. Schupmann, who was the successful competitor among the many designers who had offered their plans to the General Electric Society, which was selected as judges in connection with a special committee appointed by the government, and invested with full power to superintend the proper execution of the plans under the guidance of Herr Schupmann.

According to the resolution of the local magistrates, the following localities were selected to begin with, for the ultimate general electric illumination of the capital, namely, "Unter den Linden" (a wide avenue such as we would call a boulevard, all planted with trees), "the Lustgarten" (a public park), "Kaiser Wilhelm" street as far as "Spaudauer" street.

As the authorities had decided that all the lights should be placed at a height of 8 meters (25 feet) above the pavement, it was decided that the usual method of reaching the light by step ladders, for the renovation and adjusting of the carbons, was undesirable; consequently a method was adopted to lower the lights in a convenient manner so as to facilitate this unnecessary labor, and this resulted in the conception of a peculiar kind of support which we will now describe.

Fig. 1 represents the smallest poles, of which the total height is about 30 feet. The heavy base of the column is hollow, about 8 feet high and made of cast iron, while the shaft, for the distance of some 16 feet, for the sake of protection against fracture, is made of drawn wrought iron tubes. The top is about six feet high and also cast in ornamental style, and carries a pully, over which a chain passes, which supports the lamp at one end, while the other end passes inside the hollow shaft and carries a leaden weight which is a little heavier than the lamp, so that when this is released, after having been pulled down (by the cord seen in the engraving) and adjusted, it will again ascend by itself. The hollow column serves also the purpose of conducting the insulated wires which furnish the lamps with the required current. The wires, when they go underground, are heavily coated with a protecting rot-proof compound and simply buried in the earth, which makes the construction of expensive subways unnecessary.

These smaller posts are used in side streets, and in general in such streets as can be properly illuminated by posts placed at the curbstones, alternately right and left, at distances of 41 meters (127 feet).

The posts used in wide streets, especially such as are planted with trees (as is the case in the wide and beautiful avenue called "Unter den Linden"), the larger support represented in Fig. 2 is used. This support is some 40 feet high and is of much more solid construction. (The beautiful details of its cast iron base is represented in Fig. 3, on a larger scale.) Two of them are placed, facing one another, at each side of the street, while a metallic chain connects the tops; the lamps are suspended in the middle of this chain over the center of the roadway. The row of columns at one side of the street contains the conducting wires, while the columns at the other side contain the counterpoises for lowering and raising the lamps.

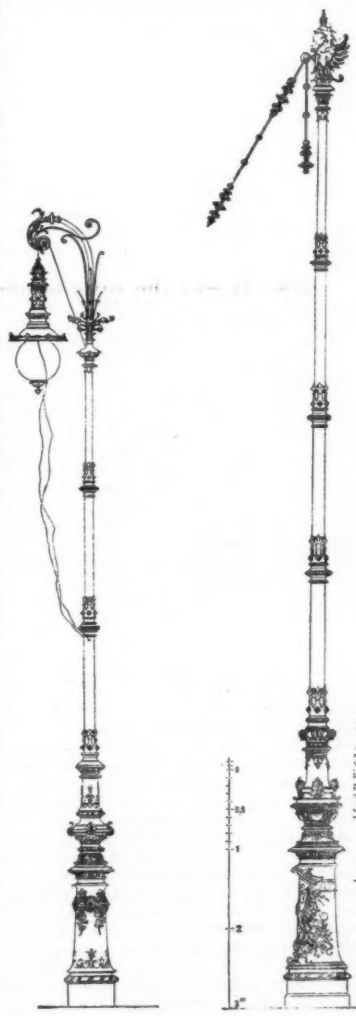


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 1.—ELECTRIC LIGHT POLE FOR SIDE STREETS.—Berlin.
FIG. 2.—ELECTRIC LIGHT POLE FOR BROAD AVENUE.—Handsomely Ornamented.
FIG. 3.—BASE OF FIG. 2, ON A LARGER SCALE.—Showing Details of Design.

The paper from which we obtain our details, gives also the important information of the cost; which, for reason of the quantity needed, was largely reduced. That of Fig. 1 was 650 marks (about $170) each, and of Fig. 2 1,200 marks (about $300), while the patterns were so constructed that, notwithstanding the highly ornamental characters, no special difficulties were offered to the easy moulding. The ornaments were selected to suggest the fundamental principles of electric illumination, "Power, Current and Light," while the national eagle at the top of Fig. 2, placed in the avenue "Unter den Linden," suggests the national, historical and triumphal character of this celebrated thoroughfare.

Practical detail is added which we must not omit to mention. In order to protect the hanging lamps against movements by wind they are suspended under a fixed funnel, serving also as a downward reflector. In Fig. 1 this funnel is represented as moveable, but is now attached rigidly to the end of the arm above the lamp.

Edison's New Theory.

The electrician, Edison, comes before the public with a new theory in regard to killing yellow fever microbes. In 1878, when trying to discover an exterminator for the Colorado potato bug, he discovered that gasoline would destroy animal matter.

Assuming that cold is an exterminator of the germ, the electrician finds that both gasoline and rhigolene lower the temperature sufficiently to prove of value in treating the fever.

Mr. Edison has not experimented with yellow fever microbes, but he has made an experiment from which he argues by analogy that he could destroy the microbes. Wrapping a thermometer in an old woolen coat he reduced the temperature from 82° to 52° in thirty minutes by drenching the coat with gasoline, and to 23° by using rhigolene which covered the coat with hoar frost. This artificial freezing process is worthy a trial, and possibly Mr. Edison may hold the key to the situation as well as a good claim on Senator Plumb's $100,000. Will the Jacksonville Board of Health give Prof. Edison a chance is the next question? —*Cincinnati Enquirer.*

The Development of Electricity.

ADDRESS BY THE PRESIDENT OF THE BRITISH ASSOCIATION, W. H. PREECE, F.R.S., BEFORE THE BATH MEETING, 1888.

"Canst thou send lightnings, that they may go, and say unto thee, Here we are?" were pregnant words addressed to Job unknown centuries ago. They express the first recorded idea in history of the potentiality of electricity to minister to the wants of mankind. From Job to Franklin is a long swing in the pendulum of time. It was not until that American philosopher brought down atmospheric electricity by his kite string in 1747, and showed that we could lead it where we willed, that we were able to answer the question addressed to the ancient patriarch. Nearly another century elapsed before this mysterious power of Nature was fairly conquered. It has been during this generation, and during the life of the British Association, that electricity has been usefully employed; and it is because I have taken a subordinate position in inaugurating nearly all of its practical applications, that I venture to make the developments of them the text of my address to this section.

People are singularly callous in matters affecting their own personal safely; they will not believe in mysteries, and they ridicule or condemn that which they do not understand. The Church itself sets its face against Franklin's "impious" theories, and he was laughed to scorn by Europe's scientific sons; and even now, though commissions composed of the ablest men of the land have sat and reported on Franklin's work in England. France, and nearly every civilized nation, the public generally remains not only ignorant of the use of lightning conductors, but absolutely indifferent to their erection, and, if erected, certainly careless of their proper maintenance. I found in a church not very far from here, the conductor leaded into a tombstone, and in a neighboring cathedral the conductor only a few inches in the ground, so that I could draw it out with my hand. Although I called the attention of the proper authorities to the absolute danger of the state of affairs, they remained in the same condition for years.

Wren's beautiful steeple in Fleet street, St. Bride's, was well nigh destroyed by lightning in 1764. A lightning rod was fixed, but so imperfectly that it was again struck. In July (1887) it was damaged because the conductor had been neglected, and had lost its efficiency. As long as points remain points, as long as conductors remain conductors, as long as the rods make proper connection with the earth, lightning protectors will protect; but if points are allowed to be fused, or to corrode away; as long as bad joints or faulty connections are allowed to remain; as long as bad earths, or no earths, exist, so long will protectors cease to protect; and they will become absolute sources of danger. Lightning conductors, if properly erected, duly maintained, and periodically inspected, are an absolute source of safety; but if erected by the village blacksmith, maintained by the economical churchwarden, and never inspected at all, a loud report will some day be heard, and the beautiful steeple will convert the churchyard into a new geological formation.

We have not yet acquired that mental confidence in the accuracy of the laws that

guide our procedure in protecting buildings from the effects of atmospheric electrical discharges which characterizes most of the practical applications of electricity. Some of our cherished principles have only very recently received a rough shaking from the lips of Professor Oliver Lodge, F.R.S., who, however, has supported his brilliant experiments by rather fanciful speculation; and whose revolutionary conclusions are scarcely the logical deduction from his novel premises. The whole subject is going to be thoroughly discussed at this meeting. We are now obtaining much valuable information about the nature of lightning from photography. We learn that it does not, as a rule, take that zig-zag course conventionally used to represent a flash on canvas. Its course is much more erratic and sinuous, construction more complicated, and pictures have been obtained of dark flashes whose *raison d'être* has not yet been satisfactorily accounted for. The network of telegraph wires all over the country is peculiarly subject to the effects of atmospheric electricity, but we have completely mastered the vagaries of lightning discharges in our apparatus and cables. Accidents are now very few and far between.

The art of transmitting intelligence to a distance beyond the reach of the ear and the eye, by the instantaneous effects of electricity, had been the dream of the philosopher for nearly a century, when in 1837 it was rendered a practical success by the commercial and far sighted energy of Cooke, and the scientific knowledge and inventive genius of Wheatstone. The metallic arc of Galvani (1790) and the developments of Volta (1796) had been so far improved that currents could be generated of any strength, the law of Ohm (1828) had shown how they could be transmitted to any distances, the deflection of the magnetic needle by Oersted in 1819, and the formation of an electro-magnet by Ampère and Sturgeon, and the attraction of its armature, had indicated how those currents could be rendered visible as well as audible.

Cooke and Wheatstone in 1837 utilized the deflection of the needle to the right and the left to form an alphabet. Morse used the attraction of the armature of an electro-magnet to raise a metal style to impress or emboss moving paper with visible dots and dashes. Steinheil imprinted dots in ink on the different sides of a line on paper, and also struck two bells of different sound to affect the ear. Bréguet reproduced in miniature the actual movements of the semaphore then so much in use in France; while others rendered practical the favorite idea of moving an indicator around a dial, on which the alphabet and the numerals were printed, and causing it to dwell against the symbol to be read—the A B C instrument of Wheatstone in England, and of Siemens in Germany. Wheatstone conceived the notion of printing the actual letters of the alphabet in bold Roman type on paper—a plan which was made a perfect success by Hughes in 1854. At the present moment the needle system of Cooke and Wheatstone, as well as the A B C dial telegraph, are very largely used in England on our railways and in our smaller post offices. The Morse recorder and the Hughes type printer are universally used on the Continent; while in America the dot and dash alphabet of Morse is impressed on the consciousness through the ear by the sound of the moving armature striking against the stops that limit its motion. In our larger and busier offices the Morse sounder and the bell system, as perfected by Bright, are very largely used; while the press of this country is supplied with news which is recorded on paper by ink dots and dashes at a speed that is almost fabulous. Sir William Thomson's mirror—the most delicate form of the needle system—where the vibratory motions of an imponderable ray of light convey words to the reader, and his recorder where the wavy motion of a line of ink spurted on paper by the frictionless repulsion of electricity performs the same function, are exclusively employed on our long submarine cables. Bakewell in 1848 showed how it was possible to reproduce *fac similes* of handwriting and of drawing at a distance, and in 1879 E. A. Cowper reproduced one's own handwriting, the moving pen at one station so controlling the currents flowing on the line wire that they caused a similar pen to make similar motions at the other distant station. Neither of these plans—the former beautifully developed by Caselli and d'Arlincourt, and the latter improved by Robertson and Elisha Gray—h ve yet reached the practical stage. The perfection of telegraphy has been attained by that chief marvel of this electrical age—the speaking telephone of Graham Bell. The reproduction of the human voice at a distance, restricted only by geographical limits, seems to have reached the confines of human ingenuity; and though wild enthusiasts have dreamt of reproducing objects abroad visible to the naked eye at home, no one at the present moment can say that such a thing is possible, while, in face of the wonders that have been done, no one dare say that it is impossible.

* * * * * *

At the meeting of the Association in Plymouth in 1877, I was able for the first time in this country to show the telephone at work. Since then its use has advanced with giant strides. There are probably a million instruments at work now throughout the civilized world. Its development has been regularly chronicled at our meetings. As far as the receiving part of the apparatus is concerned, it remains precisely the same as that which I brought over from America in 1877; but the transmitter, ever since the discovery of the microphone by Hughes in 1878, has been entirely remodeled. Edison's carbon transmitter was a great step in advance; but the modern transmitters of Mosely, Berliner, d'Arsonval, de Jongh, leave little to be desired. The disturbances due to induction have been entirely eliminated, and the laws regulating the distance to which speech is possible are so well known, that the specification of the circuit required to connect the Land's End with John o'Groat's by telephone is a simple question of calculation. A circuit has been erected between Paris and Marseilles, 600 miles apart, with two copper wires of 6½ gauge weighing 540 lb. per mile, and conversation is easily maintained between those important cities at the cost of 3fr. for three minutes. One scarcely knows which fact is the more astounding—the distance at which the human voice can be reproduced, or the ridiculously simple apparatus that performs the reproduction. But more marvellous than either is the extreme sensitiveness of the instrument itself, for the energy contained in one heat unit (gramme water degree) would, according to Pellat, maintain a continuous sound for 10,000 years. The influence which electric currents exert on neighboring wires extends to enormous distances, and communication between trains and ships in motion, between armies inside and outside besieged cities, between islands and the mainland, has become possible without the aid of wires at all, by the induction which is exerted through space itself. On the Lehigh Valley Railway, in the United States, such a system of telegraphing without wires is in actual daily use. The conduct of telephonic business in England is still in the hands of those who hold the patents, and maintain a most rigid monopoly. These patents have only a short period to run, and when they expire we may expect to find that England will not occupy the very retired position she holds now as a telephone country. Stockholm has more subscribers than London; there are 15,000 subscribers in and about New York, while the number in London is only 4,851.

Electric lighting has become popular, not alone from the beauty of the light itself, but from its great hygenic qualities in maintaining the purity and coolness of the air we breathe. The electric light need not be more brilliant than gas, but it must be more healthy. It need not be cooler than a wax candle, but it must be brighter, steadier, and more pleasant to the eye. In fact, it can be rendered the most perfect artificial illuminant at our disposal, for it can illumine a room without being seen directly by the eye; it can be made absolutely steady and uniform without irritating the retina; it does not poison the air by carbonic acid and carbonic oxide, or dirty the decorations by depositing unconsumed carbon; it does not destroy books or articles of vertu and art by forming water which absorbs sulphur acids; and it does not unnecessarily heat the room. In our Central Savings Bank in London it has been found, after two years' experience of electric lighting that the average amount of absences from illness has been diminished by about two days a year for each person on the staff. This is equivalent to a gain to the service of the time of about eight clerks in that department alone. Taking the cost at the "overtime" rate only, this would mean a saving in salaries of about £640 a year. The cost of the installation of the electric light was £3,349, and the annual cost of working £700 per annum, say a total annual cost of £1,034. The cost of the gas consumed for lighting purposes was about £700 a year, so that on the whole there was a direct saving of something like £266 a year to the Government, besides the material advantage of the better work of the staff resulting from the improved atmospheric conditions under which their work is done. The production of light by any means implies the consumption of energy, and this can be measured in "watts," or the rate at which this energy is consumed. A watt is $\frac{1}{746}$th part of a horse-power. It is a very convenient and sensible unit of power, and will in time replace the meaningless horse-power.

One candle light maintained by—		Watts.
Tallow	absorbs	124
Wax	"	94
Sperm	"	86
Mineral oil	"	80
Vegetable oil	"	57
Coal gas	"	68
Cannel gas	"	48
Electricity (glow)	"	3
Electricity (arc)	"	0.55

The relative heat generation of these illuminants may be estimated from these figures. Though the electric light was discovered by Davy in 1810, it was not until 1844 that it was introduced into our scientific laboratories by Foucault; it was not until 1878 that Jablochkoff and Brush showed how to light up our streets effectually and practically; it was not until 1881 that Edison and Swan showed how our homes could be illuminated softly and perfectly. Unpreparedness for such a revolution produced a perfect panic among gas proprietors; inexperience in the use of powerful electric currents resulted in frequent failure and danger; speculation in financial bubbles transferred much gold from the pockets of the weak to the coffers of the unscrupulous; hasty legislation in 1882 restricted the operations of the cautious and the wise; and the prejudice arising from all these causes has, perhaps fortunately, delayed the general introduction of electricity; but now legislation has been improved, experience has been gained, confidence is being restored, and in this beautiful town of Bath 50 streets are about to be lighted, and we see everywhere around and about us in our English homes the pure glow lamp replacing filthy gas and stinking oil. The economical distribution of the electric current over large area is annually receiving a fresh impetus. The expensive systems defined in the Act of Parliament of 1882 have entirely disappeared. Hopkinson in England and Edison in America showed how a third wire reduced the weight of copper needed by 66 per cent. Gaulard and Gibbs in 1882 showed how the conversion of alternate currents of high E. M. F. to currents of low E. M. F. by simple induction coils would enable a mere telegraph wire to convey sufficient electricity to light a distant neighborhood economically and efficiently. Lane Fox in 1879 showed how the same thing could be done by secondary batteries; and Planté, Faure, Sellon and Parker have done much to prove how batteries can be made to solve the problem of storage; while King and Edmunds have shown how the distribution by secondary batteries can be done as economically as by secondary generators. The Grosvenor Gallery Company in London have proved the practicability of the secondary generator principle by nightly supplying 24,000 glow lamps scattered over a very wide area of London. The glow lamp of Edison, which in 1881 required 5 watts per candle, has been so far improved that it now consumes but 2¼ watts per candle. The dynamo which in the same year weighed 50,000 lb., absorbed 150 h. p., and cost £4,000 for 1,000 lamps, now weighs 14,000 lb., absorbs 110 h. p., and costs £500 for the same production of external energy; in other words, its commercial output has been increased nearly six times, while its prime cost has been diminished eight times.

The steam engine has received equal attention. The economy of the electric light when steam is used depends almost entirely on the consumption of coal. With slow speed low pressure engines one kilowatt (1,000 watts, 1⅓ h. p.) may consume 12 lb. of coal per hour; in high speed high pressure triple expansion engines it need not consume more than 1 lb. of coal per hour. Willans and Robinson have actually delivered from a dynamo one kilowatt by the consumption of 2 lb. of coal per hour, or by the condensation of 20 lb. of steam. There is a great tendency to use small economical direct acting engines in place of large expensive engines, which waste power in countershafting and belts. Between the energy developed in the furnace in the form of heat, and that distributed in our rooms in the form of light, there have been too many points of waste in the intermediate operations. These have now been eliminated or reduced. Electricity can now be produced by steam at 3d. per kilowatt per hour. The kilowatt hour is the Board of Trade unit as defined by the Act of 1882, for which the consumer of electric energy has to pay. Its production by gas engines costs 6d. per kilowatt hour, while by primary batteries it costs 8s. per kilowatt hour. The Grosvenor Gallery Company supply currents at 7¼d. per kilowatt hour; a 20 c. p. lamp consuming 3 watts per candle, and burning 1,200 hours per annum, expends 82,000 watt hours or 82 kilowatt hours, and it costs, at 7¼d. per unit, 50s. per annum. If the electricity be produced on the premises, as is the case in the post office, in the House of Commons, and in many large places, it would cost 20s. 6d. per annum. I have found from a general average under the same circumstances, and for the same light in the General Post Office in London, that an electric glow lamp costs 22s., and a gas lamp 18s. per annum. The actual cost of the production of one candle light per annum of 1,000 hours is as follows:

	s.	d.
Sperm candles	8	6
Gas (London)	1	3
Oil (petroleum)	0	8
Electricity, glow	0	9
" arc	0	1½

The greatest development of the electric light has taken place on board ship. Our Admiralty have been foremost in this work. All our war ships are gradually receiving their equipment. Our ocean-going passenger ships are also now so illumined, and perhaps it is here that the comfort, security and true blessedness of the electric light is experienced. Railway trains are also being rapidly fitted up. The express trains to Brighton have for a long time been so lighted, and now several northern railways, notably the Midland, are following suit. Our rocky coasts and prominent landfalls are also having their lighthouses fitted with brilliant arc lamps, the last being St. Katherine's Point on the Isle of Wight, where 60,000 candles throw their bright beams over the English Channel, causing many an anxious mariner to proceed on his way rejoicing.

Fontaine showed in Vienna, in 1873, that a dynamo was reversible—that is, if rotated by the energy of a moving machine, it would produce electric currents; or, if rotated by electric currents, it would move machinery. An electric current is one form of energy. If we have at one place the energy of falling water, we can, by means of a turbine and a dynamo, convert a certain portion of the energy of this falling water into an electric current. We transmit this current through proper conductors to any other place we like, and we can, again, by means of a motor, convert the energy of the current into mechanical energy to do work by moving machinery, drawing tram cars, or in any other way. We can in this way transmit and utilize 50 per cent. of the energy of the falling water wherever we like. The waste forces of nature are thus within our reach. When that evil day arrives that our supply of natural fuel ceases, then we may look to electricity to bring to our aid the waste energies of nature—the heat of the sun, the tidal wave of the ocean, the flowing river, the roaring falls, and the raging storm. There is a mode of transport which is likely to create a revolution in the method of working tramways. A tram car carries a set of accumulators which supplies a current to work a motor geared to a pair of wheels of the car. The weight, price, day's work, and life of the accumulator is curiously the same as the weight, price, day's work, and life of horseflesh; but the cost of maintenance, the liability to accident, and the chances of failure are much less. Although very great improvements in batteries have been made, and they are now really practical things, sufficient experience in tram car working has not yet been obtained to say that we have reached the proper accumulator. Nor have we yet acquired the best motor and mode of gearing; but very active experiments are being carried out in various countries, and nothing can prevent their ultimate success.

* * * * *

The heating power of large currents has been used by Elihu Thomson in the United States, and by Bernardos in Russia, to weld metals, and it is said to weld steel without affecting its hardness. It has even been proposed to weld together in one continuous metallic mass the rails of our railways, so as to dispense entirely with joints. The production of chlorine for bleaching and of iodine for pharmaceutical purposes, the economical production of oxygen, are also processes now dependent on the electrolytic effect of the electric current.

We learn from the instructive and interesting advertising columns of our newspapers that "electricity is life," and we may perhaps read in the more historical portion of the same paper that by a recent decision of the New York Parliament, "electricity is death." It is proposed to replace hanging by the more painless and sudden application of a powerful electrical charge; but those who have assisted at this hasty legislation would have done well to have assured themselves of the practical efficacy of the proposed process. I have seen the difficulty of killing even a rabbit with the most powerful induction coil ever made, and I know those who escaped and recovered from the stroke of a lightning discharge. The fact that the energy of a current of electricity, either when it flashes across an air space, or when it is forced through high resistance, assumes the form of heat of very high temperature, led early to its employment for firing charges of gunpowder; and for many civil, military, and naval purposes it has become an invaluable and essential agent. Wrecks like that of the "Royal George" at Spithead were blown up and destroyed; the faces of cliffs and quarries are thrown down; the galleries of mines and tunnels are excavated; obstructions to navigation like the famous Hell Gate, near New York, have been removed; time guns to distribute correct time are fired by currents from Greenwich at 1 P. M. In the operations of war, both for attack and defence, submarine mining has become the most important branch of the profession of a soldier and a sailor. Big guns, whether singly or in broadside, are fired, and torpedoes, when an enemy's ship unwittingly is placed over them, are exploded by currents of electricity.

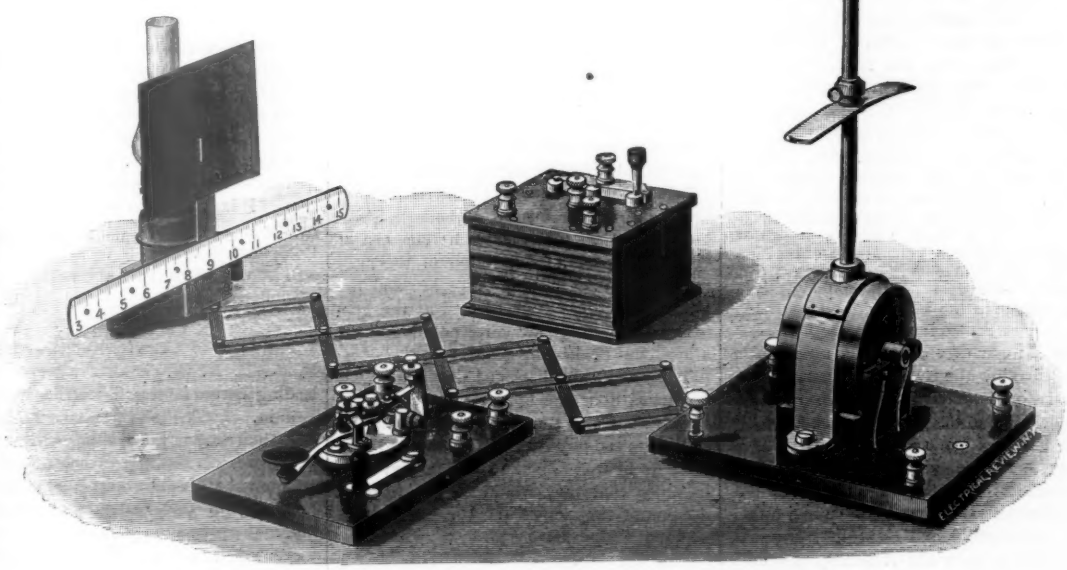
An immense amount of research has been devoted to design the best form of fuse, and the best form of generator of electricity to use to explode them. Gun tubes for firing consist of a short piece of very fine wire embedded in some easily fusible compound,

while the best form of fuse is that known as the Abel fuse, which is composed of a small compact mass of copper phosphide, copper sulphide, and potassium chlorate. The practice in the use of generators is very various. Some, like the Austrians, lean to the high tension effects of static electricity; others prefer magneto machines; others use the dynamo; while we in England cling with much fondness to the trustworthy battery. Since the electric light has also become such a valuable adjunct to war purposes, it is probable that secondary batteries will become of immense service. The strong inductive effects of atmospheric electricity are a source of great danger. Many accidental explosions of fuses have occurred. An experimental cable with a fuse at one end was laid below low water mark along the banks of the Thames at Woolwich. The fuse was exploded during a heavy thunderstorm. The knowledge of the causes of a danger is a sure means for the production of its removal, or of its reduction to a minimum. Low tension fuses and metallic circuits reduce the evils of lightning, but have not removed them. Should war unhappily break out again in Europe, submarine mining will play a very serious part, and, paradoxical as it may appear—as has been suggested by the French ambassador, M. Waddington—its very destructiveness may ultimately prove it to be a powerful element of peace.

It seems incredible that, having utilized this great power of nature to such a wide and general extent, we should be still in a state of mental fog as to the answer to be given to the simple question—What is electricity? The engineer and the physicist are completely at variance on this point. The engineer regards electricity, like heat, light and sound, as a definite form of energy, something that he can generate and destroy, something that he can play with and utilize, something that he can measure and apply. The physicist—at least some physicists, for it is difficult to find any two physicists that completely agree with each other—regard electricity as a peculiar form of matter permeating all space as well as all substances together, with the luminiferous ether which it permeates like a jelly or a sponge. Conductors, according to this theory, are holes or pipes in this jelly, and electrical generators are pumps that transfer this hypothetical matter from one place to another. Other physicists, following Edlund, regard the ether and electricity as identical, and some, the disciples of Helmholtz, consider it as an integral constituent of nature, each molecule of matter having its own definite charge, which determines its attraction and its repulsion. All attempts to revive the Franklinian or material theory of electricity, have, however, to be so loaded with assumptions, and so weighted with contradictions, that they completely fail to remove electricity from the region of the mysterious. It is already extremely difficult to conceive the existence of the ether itself as an indefinitely thin, highly elastic medium, filling all space, employed only as the vehicle of those undulatory notions that give us light and radiant heat. The material theory of electricity requires us to add to this another incomprehensible medium embedded or entangled in this ether, which is not only a medium for motion, but which is itself moved. The practical man, with his eye and his mind trained by the stern realities of daily experience, on a scale vast compared with that of the little world of the laboratory, revolts from such wild hopotheses such unnecessary and inconceivable conceptions, such a travesty of the beautiful simplicity of nature. He has a clear conception of electricity as something which has a distinct objective existence, which he can manufacture and sell, and something which the unphilosophic and ordinary member of society can buy and use. The physicist asserts dogmatically: "Electricity may possibly be a form of matter—it is not a form of energy." The engineer says distinctly: "Electricity is a form of energy—it is not a form of matter; it obeys the two great developments of the present generation—the mechanical theory of heat and the doctrine of the conservation of energy." There must be some cause for this strange difference of views. It is clear that the physicist and the engineer do not apply the term electricity to the same thing. The engineer's electricity is a real form of energy; the speculative philosopher's electricity is a vague subjective unreality which is only a mere factor of energy and is not energy itself. This factor, like force, gravity, life, must, at any rate for the present, remain unknowable. It is not known what force is; neither do we know what is matter or gravity. The metaphysician is even doubtful as regards time and space. Our knowledge of these things commences with a definition. The human mind is so unimpressionable, or language is so poor, that writers often cannot agree even on a definition. The definition of energy is capacity for doing work. We practical men are quite content to start from this fiducial line, and to affirm that our electricity is a something which has a capacity for doing work; it is a peculiar form of energy. The physicist may speculate as much as he pleases on the other side of this line. He may take the factors of energy, and mentally play with them to his hearts content; but he must not rob the engineer of his term "electricity." It is a pity that we cannot settle our difference by changing the term. Physicists might leave the term electricity to the form of energy, which is an objective reality, and which the ordinary mortal understands; while engineers would be quite content if speculative physicists and enthusiastic mathematicians would call their subjective unreality, their imaginary electrical matter, by some other term. If it be necessary to mentally create some imaginary matter to fulfil the assumptions and abstractions of their mathematical realizations, let them call it "coulombism" or "electron," and not appropriate the engineer's generic and comprehensive term "electricity." The engineer finds the motions of existing matter and of the ether quite sufficient to meet all his requirements and to account for all those phenomena which are called electrical.

It seems paradoxical to assert that two unrealities can form a reality, or that two subjective ideas can become an objective one; but it must be remembered that in all electrical phenomena that which makes them real and objective is derived from without. The motion that renders an electrical phenomena evident is imparted to it from some other form of energy. The doctrine of the conservation of energy asserts that energy is never destroyed, it is only transformed—work must be done to render it evident. No single electrical effect can be adduced which is not the result of work done, and is not the equivalent of energy absorbed. The engineer's notion of work—something done against resistance; and of power—the rate at which this change of condition is effected—are the keystones to the conception of the character of those great sources of power in nature whose direction to the uses and convenience of man is the immediate profession of those who generally assemble together in Section G of the British Association to discuss the "practical application of the most important principles of natural philosophy which has, in a considerable degree, realized the anticipations of Bacon, and changed the aspect and state of affairs in the whole world."

I cannot pretend to give a survey of all the practical applications of electricity. I have but briefly indicated the present area covered by the new and rapidly growing industry. Five million people upon the globe are now dependent on the electric current for their daily bread. Scarcely a week passes without some fresh practical application of its principles, and we seem to be only on the shore of that sea of economy and beneficence which expands with every new discovery of the properties of electricity, and spreads already beyond the mental grasp of any one single worker.



THE NEW PORTABLE TESTING SET OF THE WESTERN ELECTRIC COMPANY, NEW YORK.

A Valuable Testing Set.

On this page will be found a cut of the Western Electric Company's portable testing set, consisting of a Thomson dead beat reflecting galvanometer, with lamp, stand and scale; a set of shunts; a standard resistance coil of 25,000 ohms; and a manipulating key of special construction, admitting a variety of tests with but slight changes in the circuits.

A neat hard wood case is furnished, in which the above apparatus can be safely packed for transportation, if necessary. The case occupies a space less than one cubic foot, and, being provided with a leather handle, can easily be carried in the hand.

A standard condenser, not shown in the cut, is an essential feature of the apparatus when used for making capacity tests.

The above outfit is particularly suitable for the measurement of the electro-static capacity and insulation of cables, and is being generally adopted by electrical companies employing apparatus which must conform to standards of insulation or capacity.

Prof. Forbes on the Prevention of Overheating of Electric Wires.

Prof. Geo. Forbes, of England, read a paper at the recent meeting of the Society of Telegraph Engineers and Electricians, in which he concludes as follows:

1. One of the most important results I have obtained is that the insulation of the aerial conductor is favorable and gives us a power of using larger currents with conductors of the same size, when the diameters are not very great.

2. In small installations the question of safety from fire or injury to insulation is not likely to crop up, but the tables here calculated will always be useful to let us know the amount of heating.

3. It is satisfactory to have a set of tables which will give us the increase of temperature with any arrangement of currents and size of wires. But these tables which I have worked out are not (except in the case of large currents) a measure of the best size of conductor for any special installation. They indicate only the safety from heating.

4. In buried conductors the mass of metal must be very great indeed, the inferior limit being set by the amount of heating of the surface of the ground which is permissible.

5. In all ordinary applications of coils of wire we can calculate the rise of temperature, experiment and theory being found to be in accordance.

Islip, N. Y.—The Mutual Light Co., Islip. Capital stock, $200,000. Mahlon S. Frost and others, incorporators.

Elleridge, Onondaga Co., N. Y.—The Jordon Electric Light and Power Company, Elleridge, Onondaga. Capital $10,000.

El Paso, Texas.—The El Paso Electric Light Company, El Paso. Capital, $50,000. J. J. Gurdson and others, incorporators.

Des Moines, Iowa.—The Des Moines Electric Light Co., Des Moines. Capital, $200,000. R. L. Chase and others, incorporators.

Portland, Me.—The Johnson Electric Supply Company, Portland. Capital, $250,000. Robert L. Walker and others, incorporators.

Brooklyn, N. Y.—The Williamsburg Electric Light and Power Company, of Brooklyn. Capital, $300,000. P. W. Aims and others, incorporators.

Biddeford, Me.—The Biddeford-Saco Light and Power Company, of Biddeford. Capital, $75,000. Lyman A. Bachelder and others, incorporators.

Kittery, Me.—The United States Electro-Plating Company, Kittery. Capital, $100,000. H. R. Thompson, Newton, Mass., and others, incorporators.

Belfast, Me.—The Belfast Electric Company, of Belfast, to furnish light, heat and power to Belfast, Searsport and Northport, with a capital of $30,000.

Truckee, Cal.—Truckee Electric Light and Power Company. Capital stock, $6,000. W. H. Kruger, J. F. Moody, Jos. Marzin and others, incorporators.

Chicago, Ill.—The Combination Electric Chain Company, at Chicago. Capital stock, $100,000. Incorporators, Nels Sorenson, Julius Ebert, and Henry C. Hiunsberger.

Kittery, Me.—The United States Car Fire and Light Extinguisher Company, organized at Kittery with a capital stock of $500,000; par value of shares, $50. David M. Weston, of Boston, is president, and Adnison Boyden, of Boston, treasurer.

Osage City, Kan.—The Osage City Electric Light Company; term, 99 years. Capital stock, $15,000. Directors—O. E. McElfresh, J. L. Williams and W. T. Williams of Osage City; J. B. Marshall, H. C. Safford, J. M. Smith, James Riley and W. E. Sterne of Topeka.

Chicago, Ill.—Chicago and North Shore Rapid Transit Company; for the purpose of transportation of passengers by steam, electric or other approved motor upon an elevated railway. Capital stock, $5,000,000. Incorporators, Norman W. Gifford, Henry P. Kranzy and Alonzo McLaughlin.

Washington, D. C.—The Electro-Magnetic Boiler Cleaner Company, of Washington, D. C. President, Gen. John B. Clark; vice-president, John H. Walsh; secretary, Charles W. Schneider; treasurer, Col. E. C. McLure; general manager, Milton S. Cabell; board of directors, Gen. John B. Clark, Maj. S. A. Jonas, John H. Walsh, Hon. Patrick J. Rogers, George G. Schroeder, Mr. Charles W. Schneider, Thomas A. Green, Joseph F. Kirby, and Col. E. C. McLure.

Greenbush, N. Y.—The Greenbush Electric Light Company. President, S. L. Slade; secretary and treasurer, Robert J. Pratt; directors, John Cullen, Martin Ryan, M. E. Dunn, Wm. Kennedy, John Burns, S. L. Slade, R. J. Pratt. This company has been formed for the purpose of operating the Westinghouse alternating current system, and has put in a bid for the contract of lighting the streets of the village. The contract will probably be awarded by the trustees next week.

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Edison has given the doctors something to talk about in his yellow fever remedy. If they don't believe he is right, they apparently are not able to prove that he is wrong.

The telephone is regarded by Wm. Preece, of England, as "the chief marvel of this electrical age," and he very properly awards the honor of its invention to Prof. Alexander Graham Bell. Mr. Preece's address, which we publish in this issue, is a valuable and interesting contribution to the literature and history of electricity.

Mr. T. B. Doolittle, of the American Bell Telephone Company, pays a well-deserved compliment in this issue to the painstaking and reliable wire table work of Mr. H. D. Stanley, of the Bridgeport Brass Company. We think the electrical fraternity generally will echo the appreciation uttered by Mr. Doolittle.

The Annual Fair of the American Institute, New York, was auspiciously opened in an address by Mayor Hewitt last week. There is much to interest and instruct in the annual gatherings of this Institute, and the Fair now in progress is behind none of the preceding ones in this respect. It should be visited by every one interested in the progress of this great country.

The New England headquarters of the ELECTRICAL REVIEW are in Room 58, No. 178 Devonshire street, Boston, in charge of Mr. T. W. Sprague, formerly with the Massachusetts Institute of Technology. The REVIEW is pleased to announce that its New England business is of such growing importance as to demand the attention of a gentleman of Mr. Sprague's ability and education, and we bespeak for him a warm welcome in the electrical field in his territory.

The Electric Club, New York, begins its season of lectures Thursday evening of next week, Capt. Zalinski speaking on the timely and important topic of "Electricity Applied to Sea Coast Defences." The Club's work in this direction, for a new organization, has been particularly successful, and the Committee of Entertainment are arranging a course for the fall and winter that will be instructive, popular and timely. It is gratifying to note that the Club is constantly gaining in membership and is already an institution of which every man in the electrical field can speak with pride.

It is believed that in the near future multiplex telegraphy will form a more prominent factor in the telegraph service than at present. Results have been obtained which would indicate that the limit of transmission upon a single wire has not as yet been approached. The article we publish from the pen of Mr. Stephen D. Field, one of the earliest and ablest workers in this field, will be read with much interest. Mr. Field is the inventor of the dynamo quadruplex system, of which more than one hundred sets are in use by the Western Union at the central office in New York, and quite a number in the new central office in Pittsburgh. His remarks may be regarded as prophetic of surprising development soon to be announced in this field.

The Bureau of Information about to be established by the National Electric Light Association is likely to prove of inestimable value to the profession and in more ways than one. We wish to bespeak for its management the kindly consideration of the electrical projectors and manufacturers throughout the country. In the course of the work of compiling and recording, they will have to call upon the fraternity generally for facts and figures, and we hope they will be liberally and considerately helped to such information as they may be in search of. It is manifestly clear that it is to the advantage of all to have one central point where authentic information may be had, and likewise to the advantage of all to contribute to the general fund of information. It is true that you give, but also true that you are to receive and however valuable the information may be you contribute, it is more than likely, because of the rapidity with which discoveries are being made, that what you will be in the way of getting will more than offset what you have given.

The invitation of the Pullman Company to the projectors of the various types of electric motors, may, if carried out, lead to tests of unusual importance, because comparative. We are not quite sure that the motor people will look with favor upon the scheme as proposed, and perhaps they would be justified in declining to take part in it. The Pullman people agree to build four miles of road and would like to see the various types of electric motors tried thereon: the "overhead" trolley system, the "third rail," the "slotted main," and the secondary battery system. They agree to furnish the power from the stationary engines set up in their car works, the various competing companies supplying their own apparatus. But it should be remembered that the initial cost of some systems is greater than others, though in the long run being cheaper; others are better adapted to short lines than to long ones, and there are various other virtues and defects which appear in inadequate trials, but are seen in extended ones. Will the companies risk the chances of a snap judgment? And is the recompense offered for success sufficient for the outlay?

A METHOD OF SEARCH FOR THE BULLET IN PRESIDENT GARFIELD.

An *a priori* method of reasoning is liable to lead to false results, and an example of this, such as is frequent in untrained minds, occurred during the illness of President Garfield. It is considered that the interval of time has absolved the writer from any promises of secrecy which may have been made.

It is well known that when there was an uncertainty as to the position of the bullet in the body of the President, an eminent electrician was making investigations which might have been followed with success, had it not been for the distributing element of the steel bed-spring under the mattress.

An inventor at Baltimore whose work in matters not pertaining to electricity had done much to alleviate the condition of the sufferer at the White House, had noticed, while watching an electric arc light between his fingers, that the light appeared to shine through his fingers, and conceived the idea that if they could concentrate a sufficiently powerful electric light upon the suspected portion of the body that the light rays would penetrate the body and reveal the presence of the bullet, it being falsely assumed that as the electric light was without heat, there would be no sensation as the result of such a search.

Communicating his ideas to some officers of the Navy, they at once gave him all the assistance which could be placed before him, and a ten-light Brush dynamo was arranged to make a single light between a pair of carbons which were regulated by hand.

A manufacturer of locomotive head-lights made a reflector at very short notice whose curvature was such as to concentrate the rays reflected by the mirror upon a point at a distance of about ten feet from the mirror; that is, the mirror instead of being a paraboloid like the ordinary locomotive mirror, was an ellipsoid, the position of the light being one focus of this ellipsoid; and the light would all be concentrated at the general position in the air corresponding to the other focus of the ellipsoid.

The work was hastened day and night, and when done the apparatus gave a very brilliant effect. But before broaching the subject to the physicians, they decided that it would be well to make a preliminary trial, in order that they would be able to overcome any skepticism on the part of the doctors.

Finding, in one of the departments, a veteran in the late war who carried a bullet in the small of the back, and which he regarded as an old friend and weather prognosticator, this man very readily consented to become the subject, and the presumption was that the ray of light would at once disclose the position of the bullet in the body of the man.

Disrobing himself to the extent necessary for the condition of affairs, he stood in the proper position upon a chalk mark which had been accurately measured on the floor, and the mirror was pointed in the direction. As quick as the dynamo current was switched on, the heat as well as the light was concentrated upon the unexposed flesh in the back, searing it with a suddenness which pained him and surprised all, causing the unfortunate man to jump high and yell loudly.

After the matter had been explained to him and the proper apologies made, it was decided not to call the attention of the surgeons to the case. Therefore this is probably the first time that any one of the parties interested has ever made any allusion to it. The effect, however, is like that referred to in the topical song of the boatswain in "Billie Taylor," concerning the wounds made

> "Out on the ice, by the big polar bear,
> All on account of Eliza;"

for in this case, as in that of the boatswain, "the scar still is there," although there is not the same necessity for euphemism respecting its locality.

THE GREAT WORK IN LONG DISTANCE TELEPHONING.

Words spoken in Philadelphia can now be heard in Portland, Me., a distance of 450 miles. A member of the REVIEW's staff in New York conversed with Mr. Standford, manager of the telephone exchange at Portland, Me., on Saturday last, and heard every word distinctly. The American Telephone and Telegraph Company, of New York, of which President Theo. N. Vail and Vice-President and General Manager Ed. J. Hall, Jr., are the energetic and far-seeing executives, is to be congratulated on the successful opening up to telephone service of this vast and wealthy territory. What was at first looked upon as a doubtful venture is now rapidly becoming recognized as one of the successful and progressive moves in recent electrical history. The large and important cities of Philadelphia, New York, Brooklyn, Albany, New Haven, Hartford, Providence, Boston and Portland, with intermediate towns, are now in telephonic communication, covering a territory represented by seven States. By November 1st this company's lines between Buffalo and Albany will be completed, and the cities of Syracuse, Rochester, Utica, Auburn, etc., will enter the long distance telephonic system.

There are at the present time over 100 manufacturing establishments in the territory adjacent to New York that are daily patrons of this system, either by leasing lines or by contracting for so many hours per day, and these companies are all supplied with the improved long distance transmitter—the invention which, with the use of hard drawn copper conductors, made possible this wonderful and potent advance in the telephonic industry.

The extension of this system to Cleveland, Pittsburgh, Baltimore, Washington, Cincinnati and Chicago is now only a question of time. It is known to be electrically possible, and the experience of the American Company so far leads to the belief that it will be successful from the stern standpoint of dollars and cents.

The Earl of Crawford and Balcarres, F. R. S., R. A. S., known as one of the leading astronomers and electricians of Great Britain, expects to visit America for the first time during the coming winter. Lord Crawford has recently presented the entire equipment of his fine observatory at Dunecht, Scotland, to the British Government, to insure the permanency of the royal observatory at Edinburgh. This munificent gift has just been accepted, and will so enlarge the facilities of the Edinburgh observatory as to render it one of the foremost in the United Kingdom.

In that interesting little English pamplet, *Notes and Queries*, a correspondent announces with almost startling resonance that Edison is not the inventor of the phonograph. He has, he says, the transcript of a paper read before the British Association, long before Edison's claim appeared, in which a "Phonautograph" was described by a Frenchman named Scott (what a Gaul!) He says he can't make out the date of this MS. with certainty, so blurred it has become, but he believes it to be 1859. "At any rate," he adds, "it is easily found in the 'Transactions.'" Well, if it were so easily found, why didn't he find it before casting doubt upon the originality of a mechanism that has been accepted in good faith by the best minds in the world. Instead of doing so he goes on to doubt that Edison had any hand in putting the parts together and perfecting the apparatus. How easily such a man could be convinced that the moon is made of green cheese! We have taken the trouble to look up the paper he refers to—it was read in 1857, not in 1859—and are, therefore, in a position to give him some information on the subject. The "Phonautograph" was a phonograph only in the sense of recording or writing sound, as its name implies, but it couldn't read and, of course, it is the audible reproduction of sound that makes the phonograph so wonderful a contrivance, and it was Edison's genius that suggested it and made it a practical contrivance.

Recent Improvements in Multiplex Telegraph Apparatus.

To the Editor of Electrical Review:

The problem of increasing the carrying capacity of telegraph lines by means of apparatus designed for the transmission of several simultaneous communications, was one which early occupied the minds of electrical engineers, and some of the first attempts in this direction show genius of a very high order. That these efforts generally failed, was due not to the inability of the apparatus to accomplish the desired result, but rather to a failure on the part of the inventors to discover the cause of their defeat.

It was reserved for Mr. J. B. Stearns to first discover one of the most glaring defects, and he by his method of increasing the inductive capacity of the equating rheostat by the attachment of Varley's condenser, first rendered the duplex commercially practicable.

When the duplex of Stearns was further developed and by Edison's beautiful conception converted into the quadruplex, a new line of defects was developed, the elimination of which has called for an immense amount of good work on the part of Smith, Jones, Maver and many others. Unfortunately, however, the majority of these efforts have not been attended by that success which their ingenuity warranted, and the quadruplex remains somewhat of a fair weather contrivance to the present day.

As it is eminently true that "history repeats itself," may it not be that ignorance of the true source of disturbance is the reason that the ingenious efforts made in the direction of increasing the efficiency of the quadruplex and enlarging its capacity by the addition of more transmissions have generally been attended by more or less failure? Assuming such to be the case the writer has carried on a long series of experiments which have been attended with so much success that he feels warranted in giving publicity to them.

The evils of the existing quadruplex apparatus are apparently—

1. Battery resistance and relay resistance.
2. Magnetic inertia or self-induction, and
3. Residual magnetism.

I. In existing quadruplex apparatus the pole changer at the instant of passing its contacts, short circuits all that portion of the line resistance included in the battery. This often amounts to one-third the total line resistance. It has been experimentally determined that the "time" occupied in passing the contact points is amply sufficient to withdraw all the static charge from more than 150 miles of wire. This static charge has to be made up after the pole changer has passed its contacts, and battery flowing to line at the distant station for this purpose, causes a flutter or false signal in the distant relay which has wrongly been attributed to the "no current" period of the reversal.

To obviate this defect the writer has eliminated the battery resistance by the substitution for the battery of a shunt wound dynamo of but 75 ohms internal resistance for any desired E. M. F., and made the pole changer continuity-preserving as regards the line, but "make and break" towards the dynamo.

The effect of this substitution has been that the neutral relay no longer falls off on a reversal from the distant station, the cessations of current on the line side by induction setting up a current in the equating circuit which holds the relay armature up during the reversal. Where battery resistance is present, as in the old apparatus, enough line current passes around into the equating circuit to negative such a result. The dynamo being shunt wound offers no magnetic retardation to passing signals, and in the event of an accidental short circuiting it depolarizes itself and no harmful result is experienced.

II. The magnetic inertia or self-induction of the relay coils presents an evil which is of precisely the same nature as that experienced in trying to operate several electric motors upon a line "in series." Thus when No. 1 relay is idle its coils exercise a retarding effect upon signals intended for No. 2 and *vice versa*. This defect has been overcome by the substitution of a multiple contact relay whose armature is moved by coreless coils of comparatively few turns in the line and equating circuits, so arranged as to cut the lines of force of a most intense magnetic field. Adjustment of this relay is readily obtained by varying the intensity of its polarization by means of a small rheostat under the control of the No. 2 receiver—No. 1 being at all times in perfect adjustment and free from control of No. 2.

III. The adoption of this peculiar form of relay at once removes the evil of residual magnetism from the circuit, and the quadruplex may be operated if desired at almost any marginal rate. The ratio of 12 to 1 between the increase and decrease currents has been worked experimentally, and it is believed even higher ratios could be obtained should such a result be desirable.

Stephen D. Field.

Stockbridge, Mass., Oct. 6.

OUR BOSTON LETTER.

(Special Correspondence.)

The meeting of the Electric Club on Monday evening was largely attended despite the weather, and interest centered chiefly in the question of new club quarters. The committee engaged in looking the matter up made a report describing several estates looked at. A special meeting is called for this evening to hear a fuller report, and endeavor to reach a settlement of the matter. Resolutions of regret were offered by Mr. A. L. Rohrer, on the loss of Mr. A. V. Garratt, as an active member of the club, but congratulating him on being chosen secretary and treasurer of the National Electric Light Association. The resolutions were unanimously passed, and though Mr. Garratt was thereby placed in a rather awkward position, he responded with great tact, and deserved his most generous applause. The reports of the club secretary and treasurer made a satisfactory showing. Many new members were elected. The Wednesday talks and monthly dinners will soon be resumed, and made a regular feature during the winter.

The offices of the railway departments of the Thomson-Houston and Sprague Electric Companies present a most busy appearance in these days of West End electric railway contracts. Both companies are pushing their work to the utmost. The Cambridge aldermen may delay matters somewhat by their postponement of permission to construct and use an electric street railway in the Cambridge limits.

Messrs. Pettingell & Co., Boston, who are carrying a large line of electrical supplies, find even their present enlarged quarters no more than necessary for their increasing trade.

The Eco Magneto Clock Co., have in their office on Sumner street, Boston, a beautiful watchmen's clock, just finished by them for the Pleasant Mills Paper Co., Pleasant Mills, New Jersey. The frame is of antique oak, of very handsome design, and finely carved, while a plush lining sets off the clock and electric mechanisms. It would be an ornament for any office. The company have also finished a clock for the Standard Steel Casting Co., of Thurlow, Penn.

Long distance telephone connection was made on Thursday between Portland, Me., and Boston, New York and Philadelphia. A Providence firm gave an order for goods at Portland and the order was acknowledged at the Eastern end of the wire. All these connections will be permanent and procurable at all times.

A man named Nevens was fatally injured last week near Augusta, Me., by the explosion of four dynamite cartridges which he was warming at a portable forge. This will probably be used as a powerful argument on the dangers of the electric current, and will be about as sensible as others which are often advanced when electric lighting and power franchises are being sought. The man was engaged in setting electric light poles.

The Eddy Electric Motor, New England agency, is located at 65 Oliver St. Mr. Adams is in charge.

H. D. Stanley, of the Bridgeport Brass Co., and George T. Manson of the Okonite Co., have been Boston visitors recently.

T. W. S.

Boston, October 8, 1888.

The headquarters of the National Electric Light Association, in charge of Mr. A. V. Garratt, secretary and treasurer, have been established at No. 16 East 23d street. This is a convenient uptown location.

OUR CHICAGO LETTER.

(Special Correspondence.)

The Chicago Club held its first meeting of the fall season on the 1st inst. Mr. C. A. Brown of the Western Electric Company was advertised to read a paper, but this was postponed and the evening given up to other purposes. The topic of discussion was the proposed change of quarters. S. A. Duncan, president of the National Electric Light Association, addressed the club in his usual cheery style, and the meeting adjourned after voting farther time to the committee on new quarters.

Chicago is a town where a dynamite scare is always in the bud with a certain class, and anything in the shape of a strange box or package is always looked upon with suspicion.

The other day a little iron box, about as big as a cigar box and painted a true anarchist red, created considerable interest at one of the police stations. It was finally stuck up in the telegraph room, and the desk sergeant said "one of Prof. Barrett's men said it was for riots."

The Professor finally, on being interviewed, said the box was an electrical contrivance intended primarily to strike the hour of 12 M. on the tower bells of the engine houses. It is also intended for use by the police department. A box will be placed in each of the six precinct stations or in a station in each precinct that is convenient to one of the fire department's big bells. There will be a code of signals whereby the commanding officers can, by sounding the tower bells, call all the patrolmen to the telephones in the patrol boxes to receive instructions in case of any emergency, or summon them to the station in case of a riot or when it is necessary for any reason to mass them together. The boxes have not yet gone into operation, but the work is rapidly nearing completion.

The Washington street tunnel is to be overhauled, and when finished will be ceiled with a sheeting of steel. All the city's wires are being rearranged through the tunnel under Prof. Barrett's direction, so that the rebuilding will not interfere with them. The new line of electric street lamps will be fourteen feet above grade, the posts being of a symmetrical pattern, designed in the city engineer's office, with an iron base and wooden standard.

The city doesn't intend to be behind its neighbors in works of either art or nature, which are of a character to attract attention. While it is given to Iowa and some other of the Western and Northwestern States to have their little cyclonic dances, Chicago last week got up an experimental exhibit which was visible only to a select few. On Tuesday the wind changed rather abruptly from North to West, about 4 P. M., and a waterspout struck the river at the lighthouse. It waltzed clear of everything in the way of vessels, etc., folding in its dizzy embrace lumber, chips and dock debris generally, until it reached the life-saving station, where it barely missed the house, but badly warped a small boat lying close by. The waterspout seemed to burst as it struck the dock, a flood of spray and solid water nearly drowning out the station. No one was injured, but all who saw it were so frightened that they knew but little about it, and were happy that they were not more intimately connected with it.

The Dieckmann Electrical Company at Chicago was incorporated the other day with a capital of $100,000, for the manufacture of electric machines and apparatus, by G. F. Dieckmann, Christian Wahl and David Quigg.

Two deaths have occurred within the week—one in Cincinnati, and one in Chicago, from electric currents. The first of these was a painter named Bogardus, who was working upon a suspended ladder, painting, on the 2d. The evidence goes to show that the ladder rested upon a wire forming part of a day circuit, and the cornice on which he was at work was beneath him, so that he laid down upon the ladder to reach it. In some way he touched a portion of the wire where the insulation was off, and at the same time made a ground contact by touching the cornice.

In the second case Mr. Clark, an employé of the T.-H. Company here, was killed while handling a lamp in a circuit, within the shop of the company. That was on the 3d. Then by way of pleasant variety, during a continuous rain of several hours, two of the arc light and power company's wires had a little fourth of July behind a wooden sign in an alley, without doing any particular damage, on the 5th, and about 8 o'clock the same evening, an Edison man-hole blew up at the corner of Clark and Adams streets, and by dint of sheer fright brought every woman to her feet in a passing street car. No one was hurt.

People on the north side are walking for their health. The street car employés have struck, and the shoemakers are rejoicing thereat.

Take it all together, it has been a right lively week.

C. C. H.

Chicago, Oct. 8, 1888.

Personal.

Mr. H. C. Spaulding, of the electric motor department of the Thomson-Houston Company, an energetic and successful worker in this new field, was a New York visitor last week.

Dr. Schuyler S. Wheeler, of the Board of Electrical Control, delivered a lecture on "Electricity" last Friday evening, and had the honor of speaking to one of the largest audiences ever assembled in the Y. M. C. A. hall. The lecturer ably and interestingly handled his subject, and was assisted by Mr. F. B. Crocker.

Mr. A. C. White, superintendent of the Providence Telephone Company, paid New York a hurried visit last week. The telephone business is running nicely in Providence, and everyone is pleased with the Western Electric multiple single cord switchboard. This board will probably be put into other of their exchanges soon.

Dr. Otto A. Moses has been appointed to represent the commissioners of the Cincinnati Exposition on juries for all groups having electrical apparatus, and is spending this week in Cincinnati. The Doctor addressed the Electrical Society of that city on "Electrical Education" last Tuesday evening, the occasion being the first public meeting of the society.

Mr. S. M. Hamill, Jr., assistant secretary of the Brush Electric Company, Cleveland, will in future make his headquarters in New York as manager of the office at 36 Union Square. Mr. W. F. Swift, the secretary of the company, is compelled on account of his health to leave New York where he has been for nearly a year, and will probably make his headquarters in the South.

Secondary Batteries.

We give below a list of a few of the sales of battery recently made by the Julien Electric Co., which we think will be interesting as showing the progress made in the field of storage battery. The Julien Electric Co. has been awarded the contract for lighting the new mill of the James Ramage Paper Co., at Monroe Bridge, Mass., using its storage battery. In this mill, as in a great many others in Massachusetts, water-power is extensively used, and as light cannot be satisfactorily produced direct, the field of storage batteries in this connection is very large, and the power being available at all hours, electric light produced in this way is found to be economical for mill lighting.

The same company has recently made a great many large sales of battery, including 170 cells to the Kirby Carpenter Co., Menominee, Mich.; 112 for lighting the Bank of Commerce Building, St. Louis, Mo.; battery for use on additional trains of the Pennsylvania R. R.; for the running of additional street cars on the Lindell Street Railway Co. of St. Louis, Mo.; for the use of the Welsbach Incandescent Gas Burner Factory, Gloucester, N. J.; a lighting installation to M. D. Barr, Manager of the Edison Co. in Canada, Montreal, P. Q.; 300 cells for lighting additional trains on the Intercolonial Railway; a factory installation to Wm. Larsen, Fort Howard, Wis.; a lighting installation for the University of Michigan, Ann Arbor, Mich.; an installation to C. E. Jones & Bro., Cincinnati, O.

Telephonic News

*** At Cleveland, Ohio, the telegraph and telephone companies have filed their bonds for $20,000 with Mayor Babcock as a guarantee for the proper observance of the underground wire ordinances.

*** The new long distance telephone line between Boston and Portland, has been constructed to within a few miles of Boston and is expected to be completed quite soon and opened for business.

*** "By Direct Telephone," is the heading over columns of matter, dated at New York, and appearing in Philadelphia and Boston papers, the result of the splendid service given by the American Telephone and Telegraph Company between these cities.

*** At the meeting of the City Council of Nashville, Tenn., last week, the telephone bill, drawn up by the special committee and the board of public works as a substitute for the original bill, granting a right of way to the Cumberland Telegraph and Telephone Company, was amended by striking out the provision that the Mayor and City Council shall have the right to regulate the operation of the company, and the bill passed second reading.

*** The telephone company of Philadelphia has commenced the work of putting wires under ground. Lead covered cables are laid in wooden boxes under the streets, and the wires are carried to large poles in the center of each block, and from there they are distributed to the several subscribers in that block. A large trunk line is being laid in Market street, from river to river. Other lines branch off north and south on each of the main streets. In nearly all the blocks small streets and alleys provide convenient centers on which to erect the distributing poles. By this system all streets will be freed of wires, as well as roofs of houses, and the net work of distribution in back yards and small streets will be so small as not to be objectionable. The ordinance authorizing the laying of these underground wires and erection of poles requires the removal of all over head wires within five years, but the company expect to complete the work before that time has expired.

Telephone Communication from a Balloon.

Jacob Reese of Pittsburgh, through some correspondence with French military men, has conceived the idea of a captive balloon, which, he claims, would be a valuable adjunct in the time of war. The balloon is made of silk, and is water and gas proof. It is attached to a telephone wire, the lower end of which is wound around a large drum, which is connected to an electric motor or steam engine. In addition to the balloon and winding machinery, there will also be a portable gas manufacturing apparatus, in which hydrogen gas may be produced by the decomposition of water by the use of iron and sulphuric acid. These balloons will have a telephone and a photographic apparatus. When the apparatus is ready for use the balloon is filled with hydrogen gas, the operators get in the car, the gas is allowed to elevate the balloon and unwind the wire, one end of which is attached to the bottom of the car and the other end being wound around the drum. When the balloon has ascended to the desired height, the drum is stopped and the balloon is thus held in any position desired. While the balloon is at a standstill, observations can be made at any height, while telephone communications may be had from the car to the ground or from the ground to the car at all times when the balloon is going up or coming down. When it is desired to return, the engineer in the balloon can telephone down, and the engine is started and winds up the wire on the drum, and thus pulls the balloon down to the place it started from. It will thus be seen that the captive balloon is destined to become an important factor in all army tactics, for by its use important observations may be made.

The Telephone Operators in the Yellow Fever Districts.

The Jacksonville, Fla., Telephone Exchange did not shut down once during the yellow fever epidemic, although at one time six out of the ten operators were sick with the fever. All of them remained at their post, with one exception, and he being from the North was advised to leave and did so. All of the operators recovered. The chief operator, a young lady, Miss Kidd, got the fever, got well and then got married, and then her husband became sick and she nursed him back to health.

Mr. B. F. Dillon, manager of the Telephone Exchange (which is under the control of the Southern Bell Telephone Company), is also manager of the Western Union Telegraph Office, and like the brave man that he is, remained at his post through all, and strange to say has been sick with the yellow fever twice. General Manager D. I. Carson, of the company, a resident of New York, says too much praise cannot be given Mr. Dillon for his noble work through all the terrible sorrow and trouble that has visited Jacksonville.

At Decatur, Ala., Mr. B. Grant, manager of the telephone company, was directed to leave and was taken sick on the train and died at Louisville, Ky.

This is the only death so far in telephone circles in the South, out of seven cases of the fever.

Bread Made by Electricity.

Mr. George Stewart, F.C.S., chemist to Messrs. J. and B. Stevenson, the extensive bakers of Glasgow and London, who has been experimenting during the last twelve months with the object of discovering a method of baking bread by electricity, is reported to have been quite successful after a great deal of labor. The bread is said to be quite as well baked as by the present methods and more quickly, while there will be a very considerable saving in expense.

Paris Telephone Extension.

In 1886 the Minister of Posts and Telegraphs granted to the Société des Telephones, for thirty-five years to come, the concession of all the telephone lines then in existence or to be afterwards constructed. This concession placed an obstacle in the way of the development of the telephonic system, and the Government authorities have lately been pressed to seek some means for remedying the evil. An effective step in this direction has just been taken. M. Coulon, the Director-General of Posts and Telegraphs, has addressed to the departmental directors of his administration a circular relative to the construction of new telephone systems in towns. After setting out the actual situation of the urban State telephone systems, in which the subscribers pay an annual rent of 200fr., plus the cost of the apparatus and erection, charged for at the rate of 150fr. per kilometer of wire, the circular points out the method of procedure in the case of new urban systems. For all towns which shall apply for it, the Government authorities will draw up plans and estimates of the cost of erection and maintenance till the year 1890, and if the municipal authorities are willing to advance the money, the State will execute the work. The town will then be allowed to repay itself this advance by collecting the subscriptions till the sum is made up. In short, each town controls its own telephone system, the municipal budget provides the necessary funds, and these are repaid by the subscribers' rents.

What is Expected of a New Electric Sugar Refining Process.

From time to time the sugar trade here, writes a New York correspondent, has heard of experiments with a new process of refining sugar, which was being kept as a profound secret, but which, it was promised, would, when brought to perfection, work wonders. The only thing known about the process was that it was an electrical one. The trade has never taken more than passing interest in the experiment, and never possessed any confidence in its success. Indeed, as year has followed year without a demonstration of absolute practicability, the trade has generally regarded the whole thing with suspicion and incredulity, much as the world regards the pretensions of Mr. Keely. Lately, however, there has seemed to be something of a change of sentiment in regard to the process. Sugar men are beginning to fear that there may be something in it after all. Actual sugar, of the most beautiful crystals, manufactured by this process has been exhibited on the "street." Last week there were two tests, to which several skeptical sugar merchants were invited, and, according to all accounts, they came away greatly puzzled. A refinery has been put up in Brooklyn. The machinery has been manufactured in different parts of the world, in order that the secret might not be disclosed, and this has been put together. A final test must be made before October 10.

If on or before that date, 1,000 tons of sugar are refined by this process in a given time, it is said that English capitalists are willing to invest $15,000,000 in the enterprise. It is evident that the trade is now awaiting, with much interest, this final and conclusive test. If successful, according to the measure expected by its projectors, this process will be one of the greatest commercial sensations of the century. It would revolutionize the sugar trade. It would close the existing refineries and drive millions of capital out of the business, and break the great trust. The cost of refining by this process, as compared with that of the existing method, would be as 70 cents to $14, and the time consumed in the refining, as ten minutes to twenty-six hours. All this, of course, reads like a fairy tale. It seems preposterous, but in these days of steam and electricity, when one can put a girdle around the world in 40 seconds; when one can talk from New York to Boston; when one can reproduce by a machine the voices of friends far distant, and perhaps in the grave; when steam has annihilated space and revolutionized trade, one cannot afford to treat scornfully a new thing because it seems strange and preposterous. The inventor of the alleged new process was a German, who, after laboring eight years on the invention, died some time ago, leaving his secret with his wife and one other person.

The Western Electric Company's new building, in New York, is now up to the 7th story. The building was designed, and its construction superintended, by Architect Chas. Eidletz.

Frank E. Fisher, the inventor of the electric railway system, now in successful operation in San Jose, has applied for a franchise for an electric railway from San Jose to Alum Rock, a distance of seven miles.

Among electric light men there is quite a demand for the Schenck belt-holder and shifter, which was described in a previous issue. It is guaranteed to control dynamo belts perfectly and has been subjected to some very severe tests.

Several of the ablest English military men are considering the phonograph with a view to adopting or adapting it to military purposes. It is believed that if there were a portable form of the talking machine, a record of all orders given in army or navy engagements could be kept.

French chemists now obtain from the essence of birch bark, by rectification, an essential oil, which possesses among other properties that being fatal to insect life, and an electrically insulating substance; and these two products are so treated and combined with other substances as to produce an anti-oxidizing compound and an insulating material capable of the same applications as ebonite.

Power by compressed air is making itself felt. The length of pipe laid in Paris for the distribution of power by compressed air already exceeds 30 miles. The compressing engines are of 3,000 horse power, and about 3,000,000 cubic feet of air are compressed daily to a pressure of 80 pounds per square inch. This company is represented in New York by Messrs. R. W. Blackwell and others at 115 Broadway.

SOUTHERN ELECTRICAL NOTES.

(Special Correspondence.)

The Norfolk (Va.) Electric Light & Power Company has been incorporated, with Geo. E. Bowden, president.

The town of Reidsville, North Carolina, will decide by popular vote on October 8th, whether or not it will issue bonds to the amount of $14,000, to purchase an electric light plant.

At Huntington, West Virginia, the Electric Light and Street Railroad Company have let the contract for their power plant to the Hill Clutch Works, of Cleveland, O.

The Thomson-Houston Electric Light Company have contract to erect an electric plant for Aberdeen, Miss. The capacity will be 25 arc and 500 incandescent lights.

At Dalton, Georgia, the Thomson-Houston Electric Light Company have contracted to build an electric light plant.

The discarded carbons of the electric light form a new excitement of city life; one in Charleston, S. C., last week, threw a man with all the force of the familiar banana skin, but the rapidity of the motion was noticeably different!

The Anniston City Land Company, of Anniston, Alabama, will increase the capacity of their electric light plant by putting in an additional dynamo and engine.

No soldiers ever fought more bravely for their country than the telegraph operators at Jacksonville, Florida, who have stood at their posts like the heroes that they are. Some have fallen by the wayside, while others remain hourly, but boldly, staring death in the face.

The Rolling Mill Company, at Bessemer, Alabama, will soon have an electric light plant in operation.

The Birmingham Gas and Electric Light Company will hold a meeting October 22, to consider issuing a second mortgage of $200,000.

At a certain point in the town of Evergreen, Alabama, the magnetic needle cuts some peculiar capers which, as yet, cannot be explained. At certain places in the room it points to the needle as it should, and at other places in the same room, and perhaps only a few feet distant, it will as soon point to the East or West as anywhere else.

The office of the Western Union Telegraph Company at Atlanta, Ga., will be removed on November 1st. The lease for their new quarters will be made for five years. About fifty men are employed on the work of removal.

At Columbia, South Carolina, most of the machinery for the Congaree Gas and Electric Light Company has arrived. The foundation for the engine is already for its arrival this week.

The Brush Electric Light Company will this week take the measurements at Statesville, North Carolina, for the incandescent circuit, measurement for the arc lights having already been made.

The Central Georgia Division of the Order of Railway Telegraphers was thoroughly organized last week at Macon, Ga., in the telegraph office of the Central Railroad Depot. The chief engineer of the order, Mr. N. H. Kirsh, of Lexington, Ky., was on hand and succeeded in organizing all the details.

The Auxiliary Association has requested the Board of Health, at Jacksonville, Florida, to examine into the matter of electrical cure for yellow fever. Mr. John N. Webb and Dr. Hercules Sanche, of Birmingham, Alabama, went, last week, to Jacksonville, and offered their services, gratuitously, to the yellow fever sufferers. They guarantee a cure for each case, if they are called in when it is thought necessary to call a physician. They report quite a number of cures already. Two printers were taken ill with the fever, one morning, and by a prompt appliance of the electropose the perspiration was soon very profuse, and at 11 o'clock the following night, when the instrument was removed, the temperature was normal, and both of them reported for work the next morning. The treatment is perfectly harmless, and attended by no unpleasant effects. The theory of Mr. Webb and Dr. Sanche, his associate, is, that by a system of electrical treatment, he restores the normal condition, by producing an equilibrium of temperature. His so-called magnet is a sort of electrical garter that is placed around the patient's limb, and the other end, consisting of a magnet, is placed in a vessel of cool water. The doctor claims that if placed in warm water, it will give a person the fever, and if placed in cool water, it will cure him of it.

EDWARD A. OLDHAM.

Charleston, S. C., Oct. 2.

A Telegrapher Who Thinks He Has Not Lived in Vain.

To the Editor of Electrical Review:

I have read in your excellent Electrical Review Mr. McCleur's paper and address on his telephone work at Richmond, Va.

The use of a return wire, or what Mr. McCleur singularly calls an "artificial ground," was proposed to the Western Union Telegraph Co. 10 or 12 years ago for use on their wires between all large cities and New York, more especially those between New York and Philadelphia, Baltimore and Washington. I made this proposition in a letter to Dr. Green, by whom it was referred to one of the company's experts, with the usual result. The papers and diagrams are extant.

You and all readers of the *Journal of the Telegraph* of 8 or 10 years ago will remember, and the columns of the *Journal* will show, that I persistently attributed the troubles in the telephone to the earth connection. I was opposed by all including the distinguished Dr. Channing, whose opinion was generally accepted in preference to that of an humble telegrapher like myself.

Not only will these show my position, but all with whom I have conversed, including Mr. McCleur himself, will bear witness to my statement that I have always asserted that the troubles in the telegraph and telephone wires, usually called induction, were directly chargeable to the ground connection.

I was never met by any argument worthy of the name, to the contrary in print. While in conversation I was often met by blank silence from some, by a smile of incredulity from many and with a leer by others, including Mr. McCleur himself.

"He laughs best who laughs last."

It is my turn.

I was rather happy a year or so ago in learning from Prof. Hughes' experiments why the three-ply wire used in "The Babyhood of the Telegraph" worked so well, and I have been gratified since by other kindred intelligence that has come to me.

This last thing, however, this taking up an old idea of mine and making of it the feature of the telephone convention, is rather exhilarating.

Now, I want to find the man who wrote

"I would not live alway,"

and mildly tell him what I think of him.

Yours, very sincerely,

David Flanery.

Memphis, Tenn., Oct. 1st, 1888.

The New Weam's Postal Railway.

The Electro-Automatic Transit Company, of Baltimore, which is the owner of the Weam's electric postal railway patents, are erecting an experimental track at Laurel, near the city of Baltimore, and are engaged in experimenting with a car of special construction.

The motive power for this road will be supplied by electricity, and the cars will be controlled and the brakes applied by the same power.

The work has been set back about three weeks by the rainy weather, but 45 men are now busy joining the ends of the two mile circular track, finishing the generating house, and building the car house. Only one-quarter of a mile of track remains to be laid, and the grading is finished.

Each car is built of sheet iron, is two feet square and about 21 feet long. Two cars constitute a train, and when so joined they are connected after the vestibule pattern by a flexible connection the size of the car itself. The rails are three in number, one above for carrying the current to the car and two below constituting the return. The speed which it is expected to attain is five miles per minute. The motors for this road will be of a special type and will be furnished by the Sprague Electric Railway and Motor Company, of New York. They will be of the most approved type of 25 guaranteed h. p. each, and especially adapted for this work. The power car will carry three motors, making 75 h. p. available for driving each train. Self-oiling bearings of special type will be used. The power is furnished by a 100 h. p. Ball engine.

Yellow Fever Telegraph Reports.

The Western Union boys at the general offices in New York don't permit any familiarity on the part of the managers' reports from offices in the yellow fever districts. As soon as a Jacksonville, St. Augustine or other neighboring report is received, it is packed in a box and gingerly carried down into the cellar, and left in a secluded spot undisturbed until frost comes. Then, after having been subjected to the weather and thoroughly aired, the reports are taken up and recorded as usual. So says an operator.

The Fisher Electric Railway Successfully Started in San Jose, Cal.

The citizens of San Jose, Cal., are just now engaged congratulating themselves and inventor Frank E. Fisher, of Detroit, over the electric road now running in that city. The San Jose papers are filled with rejoicings over the advent of the electric road. The *Mercury* of that city contains the following, and the Review most cheerfully endorses the kind words given Mr. Fisher, who is one of the worthy and capable young electricians of the country:

"This procession of cars attracted the attention of the people on the streets, and at the crossing where they stopped a large crowd assembled. There was a general congratulation among all classes of our citizens. Every one seemed to feel that the doubt and uncertainty was over, the road an established fact, and that San Jose had the finest, best equipped and most extensive electric railway in the world. This feeling was expressed in the talk among the bystanders, the officers of the road were congratulated again and again, and when, after being photographed, the cars started off up Santa Clara street loaded with passengers, running easily, smoothly and swiftly, the sight was greeted with cheers from those who witnessed it. The cars have now begun to run regularly, and in a day or two the novelty for our citizens will be off, but to outsiders who visit us the road will long remain one of the principal features of the city.

"The success of the road has already had its effect, and though not 24 hours have passed away since the first regular run was made, there is already talk of laying other electric lines through the city, and a good prospect that some of them will be begun before this autumn gives way to the coming winter. Nor can it be doubted that other cities will adopt the system which has proven so successful here.

"While yesterday was a pleasant day for us, and a glad day for the directors of the road, it was in an especial manner a day of triumph for Frank Fisher. He has had more at stake than anyone. He is the inventor of the system, and his fortune has been largely dependent on the success or failure of the road in this city. He has had great difficulties to contend with of which the public know nothing. He has had not only to overlook the putting up of the electrical plant, but to superintend the construction of the road bed. He has not been without opposition from those who lacked confidence in him on account of his youth. There have been hindrances and obstructions which have occasioned delay after delay, until it seemed to many that the plant would never work, and even the most sanguine began to doubt. But through all the delay Mr. Fisher managed to retain the confidence of Messrs. Bishop & Rich and himself. He never doubted his ultimate success, and he never lost his temper. The success of his system is now beyond a doubt or peradventure, and his fortune is assured. He has shown himself not only a skillful electrician and thoroughly proficient in all parts of his profession, but a most courteous gentleman, whose genial nature has won for him here a host of friends."

The Sprague Electric Railway Work.

Since the last issue of this paper, the Sprague Electric Railway and Motor Company, of New York, have put another electric railway in operation. This is at Akron, Ohio, of which the equipment is 12 cars over 6½ miles of road. The trial trip was very successfully made, and the president and directors of the road expressed themselves as very fully pleased with its successful operation.

This company has now electric railroads in operation in the following cities: Richmond, Va.; Erie, Pa.; Reading, Pa.; Wilkesbarre, Pa.; Wilmington, Del.; Harrisburg, Pa.; Lafayette, Ind.; Carbondale, Pa.; Steubenville, O.; Boston, Mass.; Cleveland, O.; St. Joseph, Mo.; Asheville, N. C.; Salem, Mass.; Brockton, Mass.; Davenport. Ia.; Hartford, Conn.; Scranton, Pa.; Akron, O.; Manchester, Va.; Sandusky, O.; Minneapolis, Minn.

A Compliment From Most Excellent Authority.

To the Editor of Electrical Review:

I take this method of acknowledging receipt of a little pamphlet entitled "Stress Tables."

This, together with other works of a kindred nature emanating from Mr. H. D. Stanley, of the Bridgeport Brass Company, exhibits not only a keen appreciation of the needs of the electrical field, but an amount of plodding labor for which the thanks of the fraternity can hardly be an equivalent.

Yours very truly,

T. B. Doolittle.

Boston, Oct. 4th, 1888.

Electric Club Notes.

The Montreal, Canada, Electrical Society has been formed.

Mr. J. F. Mehren, of the city telegraph department, Chicago, was a New York and Electric Club visitor last week.

The sleeping accommodations at the Club are a popular feature, and nearly every night are all occupied by out-of-town members.

At the last meeting of the Committee on Membership, 17 new members were favorably reported, and there are as many more applicants.

Col. A. C. Wellington, recently deceased, was a prominent member of the Boston Electric Club. A special meeting was held, and a set of resolutions were adopted. A copy of the same was sent to the family.

Major G. S. Clarke, Royal Engineers, London, is visiting this country in the interest of the War Office, and has been examining the many valuable features of the dynamite gun. The Major was the guest of Captain Zalinski, U. S. A., and Capt. Candee at the Electric Club.

The regular meetings of the Electric Club begin October 18th, on which occasion Captain E. L. Zalinski, U. S. A., will deliver an address on "Electricity Applied to Coast Defences." There will undoubtedly be a large attendance, and the address will be of much value and interest.

The express package game, worked over the telephone, was attempted by some bunco steerer on the clerk of the Club recently. As a result, the said bunco steerer had his trouble for his pains, and the clerk has a very smooth and elegant brick, neatly done up, that didn't cost him a cent.

Mr. R. E. Turner, president of the electric light company at St. Joseph, Mo., and Col. J. A. Corby, a large stockholder in the same company, are visiting New York, investigating electrical matters. They were both Electric Club visitors, in which organization Col. Corby is an old-time member.

"The Electric Club café is the most successful one in New York, considering the time it was opened," remarked Charles A. Stevenson, the actor, while at dinner in the Club recently. Mr. Stevenson is not the only member of the Club who has discovered the excellence of its *cuisine*, and the attendance at meal time is constantly increasing.

The officers of the new Electrical Society of Cincinnati, are: President, A. R. Foote; vice-presidents, F. M. Dillie and W. H. Jones; secretary, Edgar A. Edwards; treasurer, C. E. Jones. A board of managers to have financial and business control, consisting of the officers and following members, has been elected: Geo. F. Card, L. H. Weisleder, F. E. Perry, G. P. Altenberg, H. T. Crane, Thos. Nicholson, L. W. Davis, C. B. McMeekin, F. A. Kelley, B. T. Mulligan.

General Manager J. E. Hudson, of the American Bell Telephone Company, has presented the Club, through Mr. R. W. Devonshire, with 25 elegantly bound volumes, comprising all the court proceedings in the big telephone cases. As a history of the telephone and its progress, these volumes are most valuable and interesting. If other gentlemen with large libraries would follow the example of Mr. Hudson, Mr. Edison, and Dr. Geo. H. Benjamin, all of whom made handsome book presents to the Club, its library would soon be filled.

TELEGRAPHIC

.... The Postal Telegraph Cable Company has filed with the Interstate Commerce Commission complaint against the Pacific railroads for failing to give them telegraph facilities along such lines.

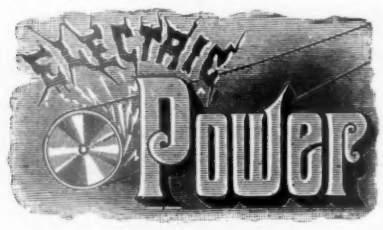
.... Manager Raymond, of the Nashville telegraph office, is after the electric light company for slinging its wires too close to the telegraph wires, and Mayor Nicklin has requested the light company to change its line.

.... The Transandine Telegraph Company will open its new direct line between Valparaiso and Buenos Ayres Oct. 1. This is an iron pole line in connection with 40 miles of cable laid under the perpetual snows of the Andes, and will insure communication between Buenos Ayres and London, via Galveston, inside of one hour and a half.

.... The *Herold*, of Milwaukee (German), obtained the first copy of the *Deutsche Rundschau* containing the Tagebuch of the dead Kaiser Friedrich, which reached New York on Monday, and had the same telegraphed verbatim in German (22,150 words) in time for Tuesday morning's edition. This feat stands unparalleled in the history of American telegraph companies as far as the transmission of so large a special in the German language is concerned.

.... A recent English dispatch says: Thomas A. Edison was received this afternoon by Col. Gourand at his beautiful villa, Little Menlo, at Upper Norwood in Surrey. A large number of ladies and gentlemen gathered to meet the distinguished inventor. Under the inspiring influence of popular appreciation Mr. Edison made a speech, in which he dwelt upon his first visit to England 18 years ago, and then devoted himself to a humorous criticism of English politics and the climate. The distinguished inventor proceeded to amaze the company by reciting "Bingen on the Rhine," and winding up with a most extraordinary whistling spasm. Then he sang Chapet's funeral march, and without waiting for an *encore* gave "Mary Had a Little Lamb." He told funny stories. Mr. Edison was not in fact present at all; he was in reality in New York, and all his songs and speeches were heard 3,000 miles away by means of a phonograph into which he had talked and sang just 10 days before.

.... In Mexico, the railway and telegraph construction is said to continue. The National Railway Company will this month complete its main line, reaching from Laredo on the Texas border, or rather from the harbor of Corpus Christi, to this city. The Interoceanic Railway Company, which is building from Vera Cruz to this city, and which eventually will run its line through to Acapulco on the Pacific coast, has its money secured in London for the eastern division of its line from here to the Gulf of Mexico, and has to-day more than $2,000,000 in cash on deposit here, with the rest of the money pledged by rich London banking houses. Engineers are now at work surveying the Oaxaca & Pacific railway, from Puebla to the Pacific Ocean, passing through the city and State of Oaxaca. The contract has been given for the Tehuantepec railway (not the ship railway) and this is in the hands of an English company. A group of New York and London people are going to build the new railway in Chiapas, from a point where navigation is possible on the Grijalva river down to the excellent port of Tonala on the Pacific. Col. Villada, who has an excellent concession for a narrow gauge railway from Zamora in the State of Michocan down to the port of Zihuatenejo on the Pacific, is treating, he tells us, with one of the richest banking houses in Europe for the transfer of his concession. The Mexican National Construction Company has in hand the building of a line to the Pacific Ocean in the State of Colima, and the Tehuantepec ship railway scheme is still alive. All of these lines are either essentially like the Interoceanic railway or the Tehuantepec railway.



Mr. Nelson Perrin, president of the Union Passenger Railway Company, is examining electric motors with a view of supplying the entire road with the electric system.

A 15 horse-power electric motor has been put into Dingley, Foss & Co.'s factory at Lewiston. It is furnished by the Lewiston & Auburn Electric Light and Power Company.

The Ft. Wayne Jenney Electric Light Company has a new electric meter that promises very well. It is said to be simple, economical and scientifically accurate, its range of error being within about five per cent., and is the work of Electrician Slattery.

The electric railroad which the Sprague Co. established at Davenport, Iowa, has been running now for some time, and the president and directors of the road express themselves as being perfectly satisfied. This is the only electrical road in operation in the State of Iowa, and the cars are filled with a great many people who are curious to try the new motive power. The system used is the regular Sprague overhead, with the small No. 6 wire as a working conductor, which is a feature upon all the Sprague roads.

The time will come when a wagon will drive up to the back door and leave a box of electricity sufficient to last at least 24 hours. The housewife will take the box and attach it to the electrical apparatus in her house, and run her sewing machine with it during the day and light her dwelling with it at night. The next morning the wagon will call and the old box will be taken away and a new one substituted. This can be done now with much more ease than a storage battery of an ordinary electric motor can be filled, and at very much less expense. In fact, if such a system were in general operation, the cost would be almost nominal. —*Henry Flad in Globe-Democrat.*

The motive power of the new electric road at St. Jose, Cal., is furnished by a Hazleton boiler of 125 horse-power and Wheeler arc engine of 100 horse-power. The electrical plant consists of two dynamos and the track itself is divided into two parts or circuits, each dynamo furnishing current to its particular section. The present equipment consists of 12 cars and the equipment will be immediately increased to 18. They will run at a speed of 10 miles per hour through the city, and on the Alameda will run at a speed of 15 miles per hour. This speed is absolutely under the control of the motor man, who varies it at pleasure. The conductors are suspended in the conduit in a manner that thoroughly protects them from climatic difficulties, and it is claimed that it is absolutely impossible for a horse, man or boy to be injured in any way by coming in contact with the electrical conductors. The cars stop and start without the jerk or lurch that is so objectionable in cable systems. The San Jose road crosses, in addition to the three bridges, two railway tracks. One is a standard gauge, and the other is a narrow gauge, double crossing, three foot gauge. The construction of the foundation for these crossings was quite a piece of engineering, and the electric cars run through the railway and the railway tracks run over the electric road without any change to the machinery of either train. The crossings are sufficiently strong and durable to stand the strain of heavy Pullman trains running at 40 or 50 miles per hour. The road was subjected to the severest tests. In one case three standard Pullman coaches, containing 300 passengers, was drawn at a high rate of speed by one dummy, which was probably the largest load ever drawn by a motor on an electrical railway.

Aids to the Comparative Investigation of Alternating and Direct Currents.

BY P. H. VAN DER WEYDE, M.D.

(Written for the ELECTRICAL REVIEW.)

As the subject of the comparative properties of alternating and direct currents is at present attracting much attention, the communication of a few devices to produce either of them from the same source, and a short account of results obtained, may be of some service to such electricians as have time and inclination to contribute their share to this interesting and new field of investigation.

I will describe two methods: Firstly, for currents of low potential, such as can be obtained from magneto-electric machines moved by hand; for instance, Saxton's or Clarke's machines, found in almost every physical cabinet. Secondly, for currents of high potential, such as are furnished by the Edison, Weston, and other direct current electric light machines.

To cause the first mentioned or low potential currents to be made either alternating or direct at will, I use a Clarke machine having the usual commutator, consisting in a ring divided into two halves, which causes the alternate currents (developed by the rotation of the armature coils in front of the poles of a bundle of steel magnets), to be carried in the same direction. To the axis of such a machine, or to its prolongation, if necessary, I add another commutator, which does not perform this function, as it consists in two separate undivided brass rings, each with its own brush and binding post. One of these rings is connected with one end of the armature coil, the other ring with the other end, reaching the rings by a longitudinal channel which perforates the axis. When, now, the binding posts of these brushes are connected with the line wire, we obtain currents which will alternate with each half revolution of the armature; breaking this connection and making it with the regular commutator of the machine, we obtain a current in the same direction, which, however, will not have the steadiness of a current obtained from a Pacinotti ring, but which will be intermittent, and by a nice adjustment of the brushes may be made almost undulatory.

In order to change a direct current of high potential, either arc or incandescent light, into an intermittent current, I take or make a small electro-motor or dynamo, and in place of the now customary armature, I insert one constructed after the old Siemens plan, namely, of the shuttle-wound longitudinal species, with its usual commutator. The difference in its construction is, however, that in place of being wound with one wire, it is wound with two wires, one of which only is connected with the commutator, and from there the entire current is led in series through the field magnet coils, so as to excite them. In so far the machine operates as a simple motor, but if the two ends of the second wire, with which the armature has been provided, are connected with a second commutator consisting of two insulated rings, brushes and binding posts, similar to those described above in the explanation of the alteration of the Clarke machine, we will obtain from this electro-motor also a very powerful alternating current of a potential differing with the size of the motor, the potential of the original current, the nature of the windings, etc. In fact, this motor performs the function of a secondary dynamo.

As, however, it would not be a fair test to compare this peculiar kind of induced alternate current with the primary direct current from which it is derived, it is also necessary (at least if a correct and reliable comparison is intended) to provide the axis with a third commutator similar to the first, and which therefore performs the same function for the induced current which the first commutator does for the direct current which drives the motor; in this way we can cause the very same induced current to be direct or alternating just as we may desire for the purpose of comparison, and then simply by connecting the line wires, either with the binding posts of commutator No. 2 or with those of commutator No. 3, in exactly the same way as we do with the modified Clarke machine for currents of low potential described above.

It is seen that for convenience sake I have considered the dynamo current as the primary, notwithstanding we are all fully aware that, strictly speaking, all dynamo currents themselves are generated by induction.

EXPERIMENTS.

1. The alternate current from a thus modified Clarke magneto electric machine was passed through a Volta gas meter, of which the electrodes consisted in broad strips of platinum (size 1 by 4 centimeters), which with the direct current evolved 1 cubic centimeter of O and 2 c. m. of H in 30 seconds. No gas whatsoever was evolved by the alternating current, as the two opposite currents neutralized one another, and if any decomposition took place on one spot, the large surface of the electrodes allowed the nascent gases to be recombined in neighboring spots.

2. Such being my conclusions I reasoned that by diminishing the surface of the electrodes I might succeed in causing perceptible electrolytic action by the alternating current, whereupon I removed the platinum strips and substituted two platinum wires No. 25, four centimeters long, placed about one centimeter apart, as before; now, the evolution of gas was profuse, equal parts were evolved at both electrodes, and the test proved the gas to be a mixture of hydrogen and oxygen in the right proportion to cause its explosive force to be at its maximum.

3. Aluminum having the reputatation of being almost as non-oxidizable as the noble metals, two aluminum wires were substituted for the platinum; now an abundant evolution of gas was noticed at both electrodes, which by analysis proved both to be pure hydrogen. In order to find where the oxygen went, the experiment was prolonged until it was found that the aluminum, which otherwise withstands oxidation so well, became oxidized by the nascent oxygen developing at its surface, and becoming entirely disentegrated fell to pieces and sunk to the bottom of the voltameter.

4. Iron, copper, zinc and similar electrodes behaved like aluminum, and evolved pure hydrogen, while they also became oxidized by the nascent oxygen.

5. Small lumps of antimony were tried as electrodes, for reason of its affinity for hydrogen in the nascent state, and the experiment confirmed the expectation; gas was developed at both electrodes, but it was not hydrogen, but antimonite of hydrogen, as proved by the same method as the Marsh test for arsenic. The antimony itself was oxidized also, so that it appears that the metal divided itself without partiality between its two friends, hydrogen and oxygen.

Metallic arsenic would, no doubt, behave like antimony and form arseniuretted hydrogen and arsenious acid. This I have not yet tried.

Next in order would be iodine which has a strong affinity for hydrogen. The iodides of metals may be successfully employed for electrodes; hydroiodic acid would be formed, and by the law of double decompositions, we may obtain oxidations and other combinations by alternate currents perhaps not obtainable in any other way.

Earthing the Secondary.

The London *Electrical Review* speaks editorially on the above subject as follows:

We are glad that our article on High Tension Distribution in the *Review* of Aug. 31st produced the criticism which we published in our correspondence columns last week. In advocating the simple plan of earthing the secondary circuits of transformers for the purpose of rendering them absolutely safe for the consumer, we were quiet aware that we were likely to meet with objections on the part of those responsible for the maintenance of the primary circuits. We are aware that this plan demands that the conductors, both primary and secondary, shall be thoroughly insulated, but as it completely protects the consumers we do not think that it should be objected to on this ground, nor do we think that any central station authorities who rightly regard their duty to the public would demur to employing this or some similar plan, merely because it enforces some additional care in preventing leakage. We can understand that the keen competition in the work of wiring houses tends to the reduction to a minimum of the care, skill, and outlay necessary to good work, and that on the part of some contractors any plan which might expose their work to a certain amount of strain, is likely to be received in a spirit of opposition. We think, however, that the result can only be beneficial. It is infinitely preferable that a little additional cost should be incurred in fitting houses in the first place, than that at some future time the occurrence of an accident should cast doubts on the suitability of the system for domestic lighting, and induce a feeling of distrust in the public mind. The plan proposed is one which we believe has been used with success, and so far we have seen no sound argument against it. Certainly our correspondent of last week advances nothing that cannot be met. The whole of his case may be stated thus: Make dangerous contacts almost impossible, detect them when they occur, and then cut them out. We say make them quite impossible. This, upon which safety depends, is the first consideration. Under the conditions now usual it is quite possible for a dangerous contact to exist for months or years between primary and secondary, and perhaps to be detected only when some unfortunate consumer happens to touch his secondary circuit and earth at the same time.

To the objection that earthing the secondary may lead to a short circuit of the dynamo, by a contact between each pole of the primary and the secondary, we reply that this result would occur just the same if no earth were used, the dynamo being to all intents and purposes short-circuited by the secondary. We are told that for this reason alone the fire underwriters would not allow earthing.

Short-circuiting of the dynamo is, however, of no great consequence as it must be remembered that the safety fuse at once cuts the transformer out of circuit, and so prevents danger to the consumer, or injury to the dynamo. As to the protection of property, which is supposed to be jeopardized by the action we advocate, we think it will be found on examination that property is in no wise affected, unless it be that of the "undertakers," whose work is not good enough to stand the test, which, regarded from every point of view, is necessary to the protection of the customers' most highly-prized possession, their lives.

As to the rules quoted, we may point out that good insulation is necessary under all circumstances. If a secondary circuit is earthed, as we recommend, it is only so treated after being found to be thoroughly satisfactory, and it should be tested occasionally with the earth wire off in order to ensure that its insulation remain good. And, if possible, let the earth wire be connected to the middle of the secondary. In advocating earthing we have no desire to express a preference for any one method. One plan may suit one transformer or set of conditions, while other plans may better suit other conditions. If the insulated metal shield between primary and secondary is good, by all means use it, and put it to earth instead of the secondary. Possibly it may be difficult to arrange so as to form an entirely protective sheath; it must not heat and it should in any case be something more than a mere foil, or it may locally be vaporized by a contact. Or again, in cases where the two windings occupy different positions on it, the iron may be earthed. Any and all of these plans are good; one or other of them must be adopted. The *absolute safety of the consumer* is the point of the greatest moment to the electrical industry and to the public, and we are convinced that, in the interests of all, the course we advocate is, in one form or other, the only one by which that absolute safety can be secured, and we do not doubt that sooner or later it will be made an imperative condition of high tension transformer distribution.

NEW ENGLAND NOTES.

W. C. Bryant, for nearly four years superintendent at the electric light station in Waterbury, Ct., has resigned his position, and will shortly open headquarters at Bridgeport for the sale of general electric supplies, and of the new double pole switchboard for incandescent lighting, of which he is the patentee. He will also introduce at Bridgeport the Warner system of standard electric time.

At a meeting of the Somerville aldermen the committee on public property reported in favor of substituting incandescent electric light in place of gas in the City Hall, which has been renovated and improved internally.

A consolidation of the Athol Electric Lighting and Power Company and of the Athol Gas Company was effected recently. F. A. Sawyer, of Portland, Me., was elected president and general manager.

The Providence common council last week received a proposition from the Rhode Island & Narragansett Electric Lighting Company to place their wires underground, space in the conduit to be also afforded for all of the city's wires.

Western Union stockholders will meet October 10th, at which time Mr. Frank Worth will probably be elected a director.

Leon M. Case, of Waterbury, Ct., started for Toronto, Canada, to run the electric light plant, exhibiting the Case engine for the Case Engine Company, of New Britain, now offering the Canadian patent for sale.

Steps are being taken at Norridgewock, Maine, to introduce the incandescent system of electric lighting. If a sufficient number of lights can be taken, the power will be brought from Skowhegan, here. 300 lights are the number asked by the Westinghouse Company, which proposes to start the enterprise.

President Ives, of the Fair Haven and Westville Horse Railroad Company, New Haven, says that he hopes to have all the cars on the road running by electricity within six months, and that he will start for Richmond, Va., within a few days to inspect an electric motor that he thinks is the one he wants. He objects to the overhead systems on account of the interference from storms, and the double line of poles required. On the Fourth avenue line in New York is a system which he thinks favorably of. It is a storage battery system, with an independent motor on each car, and requiring no wires. The expense of equipping a car is about $200. In case electricity is adopted, the present stables will be used as repair and machine shops, and the cars can be run at twice the present speed.

It will not be a great while before the National Home at Togus, Maine, will be lighted with electricity by the Electric Light Company, of Augusta. The poles are nearly all set.

The Rockland, Maine, Electric Light and Power Company made a proposition to the city government for lighting the streets by electricity, which will probably be accepted, and the lines erected this fall.

The Thomson Electric Welding Company, Boston and Lynn, has lately shipped a machine for welding iron and steel wire, to F. A. Roebling's Sons, Trenton, N. J.

The Richmond, Va., Sprague electric railway is still attracting street railway men from all points. Among the latest to investigate its workings is ex-Governor Smyth, of Manchester, N. H., who started for Richmond on Tuesday.

The quarterly meeting of the New England Electric Exchange will be held at the rooms of the Boston Electric Club, 66 Boylston street, Monday next, at 2 o'clock. The question of the incorporation of the exchange will be the principal topic of discussion.

Twenty-four incandescent and eight additional arc lights are to be placed on the streets of Malden. This will make a total of 280 incandescent and more than 100 arc lights in Malden.

A new electric light station is to be constructed in Plymouth, Mass., by the Plymouth Electric Light Company. It will be of brick with a fronting of 58 feet on Water street by 43 feet on Leyden street. The main building is to be two stories and the boiler room one. A handsome stack 10 feet square at the base, and to run up 100 feet, with a surmounting iron cap eight feet high, is already under way, and the building walls will follow as soon as the ground is cleared. The contract to install the steam plant is taken by John Post, Jr. & Co., of Boston. This will comprise an Ide compound condensing engine of 150 horse-power, a Worthington independent condenser and pump, a Wainwright corrugated copper coil feed water heater, a steel tubular boiler of 150 horse-power and a Park injector.

Mr. George B. Coleman has connected himself with the electric light company of Milford, Mass.

The City Council of Bath, Me., has passed an order authorizing the city treasurer to contract with the Bath Electric Light and Power Company to light the city hall building with incandescent lights for a term of five years.

Mr. Frank Ridlon, of the Baxter Motor Company, has been in Baltimore the past few days in consultation with the home office.

The Thomson-Houston Electric Company and the Thomson Welding Company have petitioned for permission to lay a track through Berkeley street, in Lynn, from the works to the Boston & Maine R. R., which would largely increase their facilities.

Mr. Edward Blake, of the Sprague Electric Motor and Railway Company, has been in New York the past week.

Mr. C. O. Baker, Jr., of Newark, has been a welcome New England visitor the past week.

The City Council of Manchester, N. H., are about to sign a lighting contract with the Manchester Electric Light Company for municipal lighting.

The new Plymouth Electric Light Company has purchased the old Turner's Hall building for an electric light station.

The Newburyport Electric Light Company began operations a year ago last April with one engine and boiler and a 60-light plant. It now has double the steam capacity, 190 arc lights and 350 incandescents, and the demand for lights is increasing so rapidly that it is probable the capacity of the plant will need redoubling before winter.

Honoring the New Secretary and Treasurer of the N. E. L. A.

At the meeting of the Boston Electric Club, last week, the following resolutions were unanimously adopted:

WHEREAS, Mr. Allan V. Garratt, our First Secretary, and at present Historian of this Club, and a member whose good qualities are patent to us all, has been appointed to the responsible and honorable position of Secretary and Treasurer of the National Electric Light Association, with headquarters at New York, and

WHEREAS, The acceptance of the well deserved honor will necessitate the removal of Mr. Garratt from this city to New York and consequently deprive us of the pleasure and profit of his regular presence at our gatherings, therefore be it

Resolved, That while we, the members of the Boston Electric Club, sincerely rejoice in this tribute to the ability and character of our fellow member, we cannot refrain from expressing regret at that which, while redounding to his gain, must be our loss.

Resolved, That we view with gratification the appreciation of our fellow-member's worth by so representative a body as the National Electric Light Association, and congratulate Mr. Garratt upon being the recipient of this substantial token of its confidence and regard.

Resolved, That though separated from us by a material distance, our hearts, keenly interested in his welfare, shall ever be with him to rejoice in his prosperity.

Resolved, That in retaining his services as Historian of this Club, we are glad to preserve at least one formal link that binds him to us, beside the unrecorded ties of our affection and respect.

Resolved, That these preambles and resolutions be spread upon our minutes, to be incorporated in the permanent records of the Club and that a copy of the same be transmitted by the Secretary to Mr. Garratt.

—— Superintendent McNeal has resigned from the Chattanooga, Tenn., Electric Light Company, and Superintendent De Witt, of the Brush Electric Company of the same city, will probably be his successor.

Municipal Lighting in Bangor, Me.

The city government of Bangor, Me., are wrestling with the municipal electric lighting question. At a recent meeting a special committee appointed to inquire into the advisability and practicability of establishing an electric light plant to furnish light for municipal purposes, made an exhaustive report, strongly favoring the project. In its report the committee presents statistics and opinions from cities and towns over all the country, which are, without exception, favorable to municipal lighting. The report, with a recommendation that a competent engineer be employed to make up necessary specifications of bids and to ask for bids, was adopted, and an order passed that an engineer be so employed and proposals be solicited for establishing an electric light plant to furnish light for municipal purposes. A tribute is paid by the committee to the value of the report on "Municipal Lighting" made by the City of Detroit, Mich.

Agrees With Us—But Has the Waltham Company a Non-Magnetic Watch?

The ELECTRICAL REVIEW, in speaking as it did a few days ago regarding each railroad having an expert watchmaker in its employ, voiced the sentiment of those who know what a botch job at watch repairing means to the correct running of any watch, no matter how good it might be when the alleged watchmaker took hold of it. If a man who understood the business in its every detail, say a person like Joseph Bates, of Hammond's, had charge of repairing, adjusting and rating the watches carried by any railroad company's employés, the best result obtainable would be gained, and instead of the watches varying four or five seconds a day, as the writer in the REVIEW thinks, could be brought about the average variation, and would be considerably less than that, providing, of course, that Waltham non-magnetic watches were in use, for in these days, when electricity is used for everything, a watch is liable to magnetic influences such as were never dreamed of before, and correct running in many instances is out of the question on railroads and steamboats, especially where dynamos are in use for electric lighting or other purposes; therefore, a Waltham non-magnetic watch adjusted, would give the very best possible result, and accidents caused by variation of timepieces would be unknown. The ELECTRICAL REVIEW has made a good suggestion, and it ought to be heeded by the railroad companies.—*Waltham Tribune.*

—— The Toledo, Ohio, daily press is clamoring for more electric light, and says there is no city of Toledo's size which makes so limited use of electricity for this purpose. The brilliant and powerful electric arc is as great an improvement over the gas lamp as the latter was over the dim oil lantern, which only served to make darkness visible. A degree of light which was satisfactory a dozen years ago is no longer so to a wide-awake and progressive people.

—— One Rev. C. A. Johnson, as a result of the attention which he has been giving to scientific subjects, announces that "in just 32 years from now the electricity stored in the earth will come in contact with the heated matter inside and blow this whole world up." But why not avoid this little explosion by tapping the store of electricity and using it for lighting, telegraph service and street cars? It would save heaps of money now spent for sal ammoniac, muriatic acid, soft iron and things.

—— At a recent meeting of the Nashville City Council, a communication was received from A. L. Landis, attorney of the Nashville Jenney Electric Light and Power Company, representing that the provision of the grant made said company requiring arc light wires to be placed underground, made the exercise of the right granted impracticable, and proposing to light the entire city for $18,000 a year. A bill granting a right of way, and embodying the proposition to light the city as aforesaid for $18,000 a year, was introduced, and referred to a special committee consisting of Messrs. Hanley, McCullough and Litterer. A map was presented showing how the lights would be distributed.

ELECTRIC LIGHT NEWS

—— The town of Beaver Falls, Pa., is to be lighted by the electric light,

—— The town of Dyersburg, Tenn., is contemplating electric lights for that place.

—— The Bessemer Rolling Company, of Bessemer, Ala., will put electric lights in their mill.

—— The town of Greenbush, N. Y., is asking for proposals for lighting the town with electricity.

—— The Windsor, Ontario, Electrical Railroad Company have decided not to run their cars till next spring.

—— The Lynchburg, Va., Electric Light Company is adding an incandescent plant and will be in operation shortly.

—— The Weatherford, Tex., Ice and Water Company are putting in an incandescent electric Edison plant of 600 lights.

—— The citizens of Reidsville, N. C., are to vote whether or not to issue $14,000 to expend for electric lights for the town.

—— The Greensboro, N. C., Gas Company have purchased a controlling interest in the Greensboro Electric Light Company.

—— An electric light plant at Truckee will be put in by the California Electric Light Co. Forty-five arc lights will be used.

—— Maysville, Ga., Gas Company have purchased the works of the Citizens' Gas Co. They will erect an electric light plant.

—— The Edison electric light plant at Dalles, Oregon, is nearly completed. There will be ten incandescent plants of 300 lights each, and one arc of 40 lights.

—— A permit has been granted to the Baltimore, Md., Brush Electric Light Company, for a two-story building on Constitution street, near Madison street.

—— Mr. Samuel H. Taylor, general agent for the Thomson-Houston Company on the Pacific Coast, has opened a branch office at Portland, Oregon. Business is very good with him.

—— The Brush Electric Company, of Cleveland, Ohio, have recently sold through their agent, Mr. Kempt, of Chicago, Ill., an arc light plant to the Studebaker Brothers M'f'g. Company, Paoli, Ind.

—— The Calumet & Hecla Mining Co., of Calumet, Mich., recently increased their electric light plant by purchasing a number of 2,000 c. p. arc lamps from the Brush Electric Company, Cleveland, Ohio.

—— Yunda, Kyne & Kennedy, Amsterdam, N. Y., have recently increased their Brush incandescent electric light plant by purchasing a 225 light dynamo from the Brush Electric Company, Cleveland, Ohio.

—— The Electric Light Company, of Carlinville, Ill., have recently increased their Brush arc plant by purchasing of the Brush Electric Co., Cleveland, Ohio, through Alex. Kempt, their Chicago agent, two 150 light incandescent dynamos.

—— The Brush Electric Illuminating Co., of New York, have recently ordered 230 2,000 c. p. arc lamps from the Brush Electric Company, Cleveland, Ohio, for the purpose of increasing their plant. This company is now operating between 2,500 and 3,000 arc lights.

—— The new Electric Light and Power Company of Bristol, Pa., has chosen these officers: President, Philip Halzell; secretary, S. Weir Gilkeson; treasurer, Charles E. Scott; directors, Phillip Halzell, W. H. H. White and Joseph Grundy. The capital is to be $30,000, and it is expected to have the works in operation by Dec. 15.

ELECTRICAL PATENTS

(Copies of any Patents in the following List will be sent to any address on receipt of twenty-five cents.)

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING SEPTEMBER 24, 1888.

390,196 Device for protecting electric conductors; Edward G. Acheson, Pittsburgh, Pa.

390,220 Art of splicing wire; Edward P. Frederick, St. Louis, Mo.

390,229 Magnetic cleaning apparatus; Alwin Hempel, Dresden, Saxony, Germany.

390,230 Apparatus for synchronizing clocks; Charles E. Hoefling, London, County of Middlesex, England.

390,245 Electric arc lamp; Richard H. Mather, Windsor, Conn.

390,262 Signal tube for mines; Thomas Shaw, Philadelphia, Pa.

390,281 Automatic temperature controller; Albert M. Butz, Minneapolis, Minn., assignor to the Butz Thermo Electric Regulator Company, same place.

390,301 Armature-core for dynamos; Warren S. Hill, Boston, Mass.

390,310 Electrical testing apparatus; James W. Packard, New York, N. Y.

390,318 Alternate current dynamo; Elihu Thomson, Lynn, Mass.

390,329 Electric circuit controller; August F. L. Willatowsky, Stamford, Conn.

390,413 System of electrical distribution. 390,414 Dynamo electric machine. 390,415 Dynamo electric machine or motor; Nikola Tesla, New York, N. Y., assignor to the Tesla Electric Company, same place.

390,428 Telephone; Parvin Wright, Denver, Colo., assignor of seventy one hundredths to Peter C. Horn and Cecelia R. Northrop, both of same place.

390,439 Dynamo electric machine; Charles S. Bradley, Yonkers, N. Y.

390,440 Storm protector for electric lamps; Thos. H. Brady, New Britain, Conn.

390,462 Process of making carbon filaments; Thomas A. Edison, Lewellyn Park, N. J.

390,463 Distribution and control of electricity for lighting. 390,464 System of utilizing secondary batteries; Henry Edmunds, London, England.

390,481 Electric light circuit cut-off switch; William A. Johnson, Toronto, Ontario, Canada.

390,575 Telephonic transmitting instrument; Robert D'Unger, Chicago, Ill., assignor of four-tenths to William L. Copeland, same place.

390,597 Porous cup for galvanic batteries; Ernest M. Hewett, Newton, assignor by direct and mesne assignments to James L. Little, Jr., Brookline, Mass.

390,619 Apparatus for removing ice from railway tracks; Elias E. Ries, Baltimore, Md., assignor to Ries and Henderson, same place.

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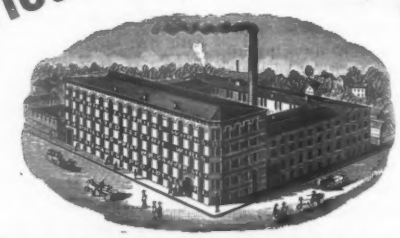
FRESH TESTIMONIALS TO THE SUPERIORITY OF
SIMPLEX WIRE.

THE VIRGINIA ELECTRIC LIGHT & POWER COMPANY, OF RICHMOND, VA.
NEW YORK OFFICE, 63 WALL STREET.
New York, August 21st, 1888.
A. F. MASON, Esq.,
SIMPLEX ELECTRICAL CO.,
Boston, Mass.
Dear Sir:
I have been using the Simplex Wire on a large portion of our lines in Richmond, Va., for the past five months. I have taken daily tests of the insulation during that time. The longest single circuit I have is about five miles, and at no time has the insulation test ever been less than one megohm. I cannot speak too highly of the wire or its insulation. A large portion of it has been run through foliage and trees in the streets, and upon examination a few days ago I failed to find any place where the wire has been abraded by coming into contract with the branches of trees. My instrument does not measure over one meghom, and I cannot tell how much higher the insulation may have measured. One megohm on wires in circuit is euough for me.
Yours very truly,
W. H. COLE, *Superintendent.*

THOMSON-HOUSTON ELECTRIC CO.,
AUGUSTA, GA.
August 12th, 1888.
Dr. A. F. MASON,
SIMPLEX ELECTRICAL COMPANY,
328 Washington St., Boston, Mass.
Dear Sir:
We are using in our arc-lighting circuits about twenty (20) miles of your Simplex T. Z. R. wire.
We have feund the insulation a most perfect protection against moisture and the abrasion of small tree limbs.
Have used your wire in our station, for running through trees, on buildings and porches, under mouldings, etc., and through cellars, and we have never been able to discover a "ground" upon any circuit since our plant was put into operation.
Very truly yours,
JOHN H. WATERMAN.

ADDRESS,
The Simplex Electrical Co.,
328 WASHINGTON STREET, BOSTON, MASS.

EUGENE F. PHILLIPS, PRESIDENT. W. H. SAWYER, SEC'Y AND ELECTRICIAN.
American Electrical Works

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